Air Resources Board

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MEMORANDUM

TO: John Sanders, Chief
Environmental Monitoring and Pest
Management Branch
Department of Pesticide Regulation

FROM: George Lew, Chief
Engineering and Certification Branch
Monitoring and Laboratory Division

DATE: September 25, 2000

SUBJECT: FINAL REPORT FOR THE 1999 ATRAZINE AIR MONITORING

Attached is the final "Report for the Application and Ambient Air Monitoring for Atrazine." The separate volume of appendices for the report has been forwarded to Randy Segawa and Pam Wales of your staff and is available upon request. We appreciate your July 17, 2000, comment memo on the draft report and have made the corrections and changes you recommended.

If you or your staff have questions or need further information, please contact me at (916) 327-0900 or Kevin Mongar at (916) 323-1169.

Attachment/Separate Appendices

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State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

Report for the Application and Ambient Air Monitoring for Atrazine

Testing Section
Engineering and Certification Branch
Monitoring and Laboratory Division

Project No. C99-035 (Ambient)
C99-035a (Application)

Date: September 25, 2000

Approved:

Kevin Mongar, Project Engineer

Acting Manager
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George Lew, Chief
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This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Summary

Report for the Application and Ambient Air Monitoring for Atrazine

This report presents the results of application and ambient air monitoring for the pesticide atrazine. Application monitoring was conducted in Sacramento County around the use of atrazine as an herbicide on 121 acres of sudan grass from June 8 to 13, 1999. Ambient monitoring was conducted to coincide with the use of atrazine on sudan grass in Sacramento and San Joaquin Counties from May 17 to June 29, 1999. Tables 4 and 7 present the results of application and ambient air monitoring for atrazine, respectively. Summaries of the application and ambient results are presented as Tables 5 and 8 respectively. The application sample results have also been summarized as associated with sampling period wind roses in Figures 4 through 13. Laboratory results, in units of ng/sample, equal to or above the estimated quantitation limit (EQL) of 22.0 ng/sample are reported to 3 significant figures. Laboratory results equal to or above the method detection limit (MDL) of 4.41 ng/sample but below the EQL are reported as detected (Det). Air concentration results (in units of ng/m^3 and pptv) are reported to 2 significant figures. The air concentration, expressed in units of ng/m^3 (or pptv), associated with the EQL is dependent on the volume of air sampled which varies from sample to sample. For a 24-hour sampling period at 3 Lpm the air concentration would be 4.8 ng/m^3 (0.56 pptv) for atrazine as associated with the EQL.

Of the four application background samples, three had results of "detected" and the east backgound sample had a result of 11 ng/m^3. Of the thirty-six application samples collected (spikes, blanks, collocated and background samples excluded) sixteen were found to be above the EQL for atrazine, twelve sample results were "detected", seven sample results were <MDL and one sample was invalidated due to a sampling pump problem. The highest atrazine concentration, 290 ng/m^3 (33 pptv), was observed at the east sampling site during the 2nd sampling period (1 hour). This result was the higher of 2 collocated samples, the average of which was 220 ng/m^3.

Of the one-hundred-twenty ambient samples collected (spikes and blanks excluded and using the highest result of each collocated sample pair), three were found to be above the EQL for atrazine, forty-two were found to have results of "detected", seventy-four were below the MDL and 1 sample was lost during analysis. The highest atrazine concentration, 6.8 ng/m^3 (0.77 pptv), was observed at the Galt office of the Sacramento County Agricultural Commissioner (GAL) sampling site.

Acknowledgments

Staff of the ARB Testing Section collected the ambient and application samples. Assistance was provided by the Sacramento and San Joaquin County Agricultural Commissioner's Offices. Method development and chemical analyses were performed by Bob Okamoto of the Evaluation Section Laboratory. Neil Adler of the Testing Section prepared the sampling tree and application site diagrams presented in this report.

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Report for the Application
and Ambient Air Monitoring for Atrazine

I. Introduction

At the request of the California Department of Pesticide Regulation (DPR) (November 4, 1998 memorandum, Okumura to Lew), the Air Resources Board (ARB) staff determined airborne concentrations of the pesticide atrazine. Application monitoring was conducted in Sacramento County around the use of atrazine as an herbicide on 121 acres of sudan grass from June 8 to 13, 1999. Ambient monitoring was conducted to coincide with the use of atrazine on sudan grass in Sacramento and San Joaquin Counties from May 17 to June 29, 1999. This monitoring was done to fulfill the requirements of AB 1807/3219 (Food and Agricultural Code, Division 7, Chapter 3, Article 1.5) which requires the ARB "to document the level of airborne emissions .... of pesticides which may be determined to pose a present or potential hazard..." when requested by the DPR. Method development and sample analyses were conducted by the ARB Evaluation Section Laboratory. Site selection and sample collection for the application and ambient studies were conducted by Testing Section staff.

The protocol for the application and ambient air monitoring for atrazine is enclosed separately as Appendix I (page 1 of a separate volume of appendices to this report).

The laboratory report, "Atrazine Method Development and Atrazine Analytical Results for Ambient Monitoring and Application Samples", is enclosed separately as Appendix II (page 46 of the separate volume of appendices to this report). The sampling/analysis Standard Operating Procedures (SOP) are also enclosed in Appendix II (page 74 of the separate volume of appendices to this report).

The pesticide use report for the application study is enclosed separately as Appendix III (page 81 of the separate volume of appendices to this report).

The DPR's November 4, 1998 memorandum, "Use Information and Air Monitoring Recommendation for the Pesticide Active Ingredient Atrazine" is enclosed separately as Appendix IV (page 82 of the separate volume of appendices to this report).

The application and ambient field log sheets are enclosed separately as Appendix V (page 97 of the separate volume of appendices to this report).

The application meteorological monitoring results are enclosed separately as Appendix VI (page 108 of the separate volume of appendices to this report).

II. Chemical Properties of Atrazine

The following information regarding the chemical properties of atrazine was obtained from the DPR's November 4, 1998 memorandum, "Use Information and Air Monitoring Recommendation for the Pesticide Active Ingredient Atrazine" (page 82 of appendices).

Atrazine (CAS:1912-24-9) exists as colorless or white crystalline powder. It has a molecular formula of $C_8H_{14}N_5Cl$ and a molecular weight of 215.7 g/mole. Atrazine has a water solubility of 32.5 mg/L at 22 °C. It has a vapor pressure of 3.00×10^{-7} mmHg at 25°C and a Henry's

Constant of 1.45 x 10^{-9} atm·m^3/mol at 22°C. Atrazine is moderately soluble in most organic solvents.

Atrazine's acute LD_{50} is 1869-3080 mg/kg for rats (technical grade material). Its acute inhalation LC_{50} (4 hour) for rats is >5.8 mg/L air. Atrazine's LC_{50} (96 hour) is 4.5-11.0 mg/L for rainbow trout and 16 mg/L for bluegill sunfish.

III. Sampling

A sketch of the sampling apparatus is shown in Figure 3. Samples were collected by passing a measured volume of ambient air through XAD-2 resin. The XAD-2 resin tubes were obtained from SKC (#226-30-06). Rotameters were used to control sample flow rates. The rotameters were adjusted to the correct flow (3 Lpm) before each 24-hour sampling period and checked at the end of each sampling period using a calibrated digital mass flow meter. The sampling system operated continuously with the exact operating interval noted. Samplers were leak checked before and after each sampling period with the sampling cartridges installed. The beginning and ending flow rates were recorded in the field log book (see appendices pg. 97). If the ending flow rate was greater than 10% different from the beginning flow rate then the values were averaged to determine the total sample volume. The resin tubes were protected from direct sunlight and supported about 1.5 meters above the ground (or roof) during the sampling period. At the end of each sampling period the tubes were capped and placed in culture tubes with an identification label affixed. The field log book was used to record start and stop times, sample identifications, start and stop flow rates and any other significant comments. Subsequent to sampling, the samples were shipped or transported on dry ice, as soon as reasonably possible, to the Evaluation Section Laboratory in Sacramento. The samples were then stored in the freezer until extraction and analysis.

A. Application Monitoring

The DPR's monitoring recommendation suggested that application-site air monitoring should be conducted in Sacramento County during the same months as the ambient study, in association with use on sudan grass at the highest rates of use; i.e., about 2.0 pounds per acre.

A 121 acre sudan grass field (actually 2 adjacent plots) was chosen for the application monitoring site. Refer to Figure 2 for a diagram of the application site. Refer to Appendix III (page 81 of appendices) for a copy of the pesticide use report.

Information collected regarding the application included: 1) the elevation of each sampling station with respect to the field, 2) the orientation of the field with respect to North (identified as either geographic or magnetic), 3) an accurate record of the positions of the monitoring equipment with respect to the field, including the distance each monitor is positioned away from the edge of the field and an accurate drawing of the monitoring site showing the precise location of the monitoring equipment and any wind obstacles with respect to the field, 4) the field size, 5) the application rate, 6) formulation and 7) method and length of application. Details regarding the site and application are summarized below in Table 1.

Table 1.
Application Information

Range/Township/Section:	R:6E/T:5N/S:3
Product Applied:	Aatrex Nine-0
Type of Application:	Ground spray
Application Rate:	2.21 pounds product per acre in 25 gall. of water per acre (1.89 lbs. atrazine A.I. per acre) (the formulation also contains 4.5% "related compounds")
Applicator:	Matt Kuil

A three day monitoring period was recommended in the DPR's November 4, 1998 memorandum with intended sampling times as follows: (where the first sample is started at the start of application) during application, followed by a 1-hour sample, a 2-hour sample, a 3-hour sample (or up to 1 hour before sunset), a 6-hour sample (or up to 1 hour before sunset), overnight (until 1 hour after sunrise), daytime (until 1 hour before sunset), overnight (until 1 hour after sunrise) and 24 hour (until 1 hour after sunrise).

Background samples were taken at each position to establish if any atrazine was detectable in the air before the application (i.e., from nearby applications). The background samples were collected from 1030 to 1030, June 8 to 9, 1999 (24 hours). The application started at 0645 and ended at 0830 on June 10, 1999. The ground spray application was conducted by tractor and started in the northwest corner, proceeding all the way around the perimeter of the field followed by north/south passes again starting at the northwest corner. Table 2 lists the approximate sampling periods.

Table 2.
Application Sampling Periods

Period		Date	Time
Background	24 hours	6/8-9/99	1030 to 1030
1	Application (1.75 hours)	6/10/99	0645 to 0830
2	1 hour	6/10/99	0830 to 0930
3	2 hours	6/10/99	0930 to 1130
4	4 hours	6/10/99	1130 to 1530
5	4 hours	6/10/99	1530 to 1945
6	11.5 hours (overnight)	6/10-11/99	1945 to 0700
7	13 hours (daytime)	6/11/99	0700 to 2000
8	11 hours (overnight)	6/11-12/99	2000 to 0700
9	24 hours	6/12-13/99	0700 to 0700

Four samplers were positioned, one on each side of the field. A fifth sampler was collocated at the east position. The west, north, east and south samplers were positioned approximately 40 feet, 15 feet, 60 feet and 15 feet from the field respectively. The east samplers were at the same elevation, the north and south samplers were 2 feet higher, and the west sampler was 1.5 feet lower than the field.

The meteorological station (oriented toward geographic north) was positioned on the west side of the field near the "west" sampler. The meteorological station was set up to determine wind speed and direction, air temperature, barometric pressure and relative humidity. The raw

meteorological station data is available on a 1.44 MB diskette (comma delimited text format). Appendix VI (page 108 of the appendices) lists the meteorological station data in 15 minute averages for the test period. A mechanical failure in the meteorological station caused a 24 hour gap in data collection, from 0800 on 6/11/99 to 0800 on 6/12/99. However, data from a backup (Davis Instruments) meteorological station, which was collocated with the primary station, has been added to the data table in 30 minute increments to cover that period. ARB staff noted the degree of cloud cover, on the sample log sheet, whenever sample cartridges were changed. The sky conditions were clear during the study period.

B. Ambient Monitoring

Ambient monitoring took place during a six week period from May 17 to June 29, 1999. Four sampling sites were selected by ARB personnel from the areas of Sacramento and San Joaquin Counties where sudan grass farming occurs and in populated areas or in areas frequented by people. Sites were selected with considerations for both accessibility and security of the sampling equipment. Background samples were collected at the ARB ambient air monitoring station in downtown Sacramento. The five sites are presented in Figure 1 and listed in Table 3. Twenty-four hour (approximately) samples were taken Monday through Friday (4 samples/week) at a flow rate of 3 Lpm. A total of 120 samples (plus 30 collocated samples, 6 trip blanks and 12 quality assurance spikes) were collected.

Table 3.
Ambient Sampling Sites

HER	Arcohe School 11755 Ivie Road Herald, CA 95638 Range/Township/Section: R.7E/T.5N/S.8	(209) 748-2313 Richard Draeger Vice Principal
MRE	Marenga Ranch Elementary School 1000 Elk Hills Drive Galt, CA 95632 Range/Township/Section: R.6E/T.5N/S.14	(209) 745-5470 Janet Handley Principal
GAL	Sac County Ag Commissioner, Galt Office 520 N. Lincoln Way Galt, CA 95632 Range/Township/Section: R.6E/T.5N/S.22	(209) 745-4109 Debbie Thomson
TER	Reclamation District 548 field yard 14807 W. Terminus Drive Lodi, CA 95242 Range/Township/Section: R.4E/T.3N/S.12	(209) 369-4123 Bill Andres
ARB	ARB Air Monitoring Station 1309 T Street Sacramento, CA 95814 Range/Township/Section: R.4E/T.8N/S.1	

The Arcohe School is in the small town of Herald. There were sudan grass fields approximately

1.5 miles to the west of the school. The sampling unit was placed on the roof of a one-story building at a height of approximately 15 feet. The sampling cartridges were positioned approximately 4 feet above the roof. Thus, air was sampled through the cartridges at a height of approximately 19 feet.

The Marenga Ranch Elementary School is in the newer residential area of north Galt. There were sudan grass fields approximately 2 to 3 miles to the northwest of the school. The sampling unit was placed on the roof of a one-story building at a height of approximately 22 feet. The sampling cartridges were positioned approximately 4 feet above the top of the container. Thus, air was sampled through the cartridges at a height of approximately 26 feet.

The Galt office of the Sacramento County Agricultural Commissioner is located in a residential/business area in Galt. There were sudan grass fields at a distance of approximately 1.5 to 2 miles to the west. The sampling unit was placed on the top of the single story building at a height of approximately 14 feet. The sampling cartridges were positioned approximately 4 feet above the roof. Thus, air was sampled through the cartridges at a height of approximately 18 feet.

The Recreation District office is in a sparsely populated area just north of the small town of Terminous. There were corn fields directly to the north, east andsoutheast. The sampling unit was placed on the top of a storage container at a height of approximately 6 feet. The sampling cartridges were positioned approximately 4 feet above the roof. Thus, air was sampled through the cartridges at a height of approximately 10 feet.

The background monitoring was conducted at the ARB air monitoring site in downtown Sacramento. The sampler was placed on the second-story roof near other monitoring equipment at a height of approximately 28 feet. The sampling cartridges were positioned approximately 4 feet above the roof. Thus, air was sampled through the cartridges at a height of approximately 32 feet.

IV. Analytical Methodology

The "Standard Operating Procedures for Sampling and Analysis of Atrazine in Ambient Air" are enclosed as Appendix III (page 74 of appendices). The procedures specify that the exposed XAD-2 resin tubes are stored in an ice chest on dry ice or in a freezer until desorbed with 3 mL of 50:50 ethyl acetate/acetone. The adsorbent is spiked with 300 ng of atrazine-$^{13}C_3$, as an internal standard, prior to extraction. The splitless injection volume is 1 uL. A gas chromatograph with a DB-5MS capillary column and a quadrapole mass spectrometer (MS) is used for analysis. The MS detector is operated in selected ion monitoring mode.

V. Application and Ambient Results

Tables 4 and 7 present the results of application and ambient air monitoring, respectively, for atrazine. Summaries of the application and ambient results are presented in Tables 5 and 8 respectively.

The Evaluation Section Laboratory determined the analytical MDL as (3.14)(s); where s is the standard deviation calculated for the results of seven replicate resin spikes (near the estimated detection limit). The MDL was 4.41 ng/sample for atrazine. The estimated quantitation limit (EQL), calculated as 5 times the MDL, was 22.0 ng/sample for atrazine. Results equal to or

above the MDL but below the EQL are reported as detected (Det). Laboratory results, in units of ng/sample, equal to or above the EQL are reported to 3 significant figures. Air concentration results (in units of ng/m^3 and pptv) are reported to 2 significant figures. The air concentration, expressed in units of ng/m^3 (or pptv), associated with the EQL is dependent on the volume of air sampled which varies from sample to sample. For a 24-hour sampling period at 3 Lpm the air concentration would be 4.8 ng/m^3 (0.56 pptv) as associated with the EQL for atrazine.

The equation used to convert atrazine air concentration from units of ng/m^3 to pptv units at 1 atmosphere and 25 °C is shown below.

$$pptv = (ng/m^3) \times \frac{(0.0820575 \text{ liter-atm/mole-°K})(298°K)}{(1 \text{ atm})(215.7 \text{ gram/mole})} = (0.1134) \times (ng/m^3)$$

A. Application Monitoring Results

The application sample results have also been summarized as associated with sampling period wind roses in Figures 4 through 13. The spokes of the wind roses correspond to the compass direction of origin of the wind. For example, the breezes were predominantly from the west/southwest during the background sampling period. The segments of each spoke correspond to incremental increases in wind speed (knots), as illustrated by the legends. The length of the spoke (and each segment) corresponds to the portion of the sampling time that the wind was from that direction (at that speed).

Of the four application background samples, three had results of "detected" and the east backgound sample had a result of 11 ng/m^3. Of the thirty-six application samples collected (spikes, blanks, collocated and background samples excluded) sixteen were found to be above the EQL for atrazine, twelve sample results were "detected", seven sample results were <MDL and one sample was invalidated due to a sampling pump problem. The highest atrazine concentration, 290 ng/m^3 (33 pptv), was observed at the east sampling site during the 2nd sampling period (1 hour). This result was the higher of 2 collocated samples, the average of which was 220 ng/m^3.

B. Ambient Monitoring Results

Of the one-hundred-twenty ambient samples collected (spikes and blanks excluded and using the highest result of each collocated sample pair), three were found to be above the EQL for atrazine, forty-two were found to have results of "detected", seventy-four were below the MDL and 1 sample was lost during analysis. The highest atrazine concentration, 6.8 ng/m^3 (0.77 pptv), was observed at the Galt office of the Sacramento County Agricultural Commissioner (GAL) sampling site.

Referring to Appendix V (appendices page 99), an apparent documentation error was made in the field log sheet when recording the end sampling times for application samples S7, E7, E7D, W7 and N7 and for the start sampling time for sample S8. These times, respectively, were actually: 2000, 2015, 2015, 2020, 2030, and 2000.

VI. Quality Assurance

Field quality control (QC) for the application monitoring included the following:

1) Four field spikes (same environmental and experimental conditions as those occurring at the time of ambient sampling) prepared by the Evaluation Section staff. The field spikes were obtained by sampling ambient air at 3 Lpm for the same duration as the background samples (i.e, collocated with a background sample);
2) four trip spikes;
3) replicate samples (collocated) collected at one of the four sampling sites;
4) a trip blank; and
5) background samples at each side of the field.

Field QC for the ambient monitoring included the following:

1) Four field spikes (same environmental and experimental conditions as those occurring at the time of ambient sampling) prepared by the Evaluation Section staff; the field spikes were obtained by sampling ambient air at the background monitoring site for 24 hour periods at 3 Lpm (collocated with an ambient sample);
2) four trip spikes;
3) replicate (collocated) samples taken for six dates at each sampling location; and
4) six trip blanks;

Rotameters were used to control the sampling flow rate. The flow rates were set at the start of every sampling period (every sample) using a calibrated digital mass flow meter (battery operated). The flow rates were also checked and recorded at the end of each sampling period using the mass flow meter. The mass flow meter was calibrated by the ARB Standards Laboratory.

The laboratory instrument dependent parameters (reproducibility, linearity and EQL) are discussed in the SOP (page 74 of the appendices). A chain of custody sheet accompanied all samples.

VII. Quality Assurance Results

A. Method Development

Refer to Appendix II (page 46 of the appendices) for discussion and results of method development studies. The freezer storage stability study results (pg. 50 of appendices) show that atrazine is stable for at least 8 weeks. All of the ambient and application samples were analyzed within 15 days of reciept.

B. Trip Blanks

The application trip blank and the 6 ambient trip blanks had results of <MDL for atrazine.

C. Application Background Sample Results

Of the four application background samples, three had results of "detected" and the east backgound sample had a result of 11 ng/m^3.

D. Collocated Sample Results

Six collocated pairs of samples for the application study had results both above the EQL. The

relative differences (100 x difference/average) of the data pairs ranged from 0% to 67%.

Only one of the ambient collocated pairs had both results above the EQL. The relative difference (100 x difference/average) of the data pair was 17%.

E. Laboratory, Trip and Field Spikes

Laboratory, trip and field spikes are all prepared at the same time and at the same level. The spikes are prepared in replicate sets of four (4) to allow statistics to be applied if necessary to evaluate differences in the results of the three sets. The laboratory spikes are placed immediately in a freezer and kept there until extraction and analysis. The trip spikes are kept in a freezer until transported to the field. The trip spike samples are kept on dry ice in an ice chest (the same one used for samples) during transport to and from the field and at all times while in the field except for trip spike sample log-in and labeling. The field spikes are kept in a freezer until transported to the field. The field spike samples are kept on dry ice in an ice chest (the same one used for samples) during transport to and from the field and at all times while in the field except for the sampling period. Field spikes were collected at the same environmental and experimental conditions as those occurring at the time of ambient sampling. The field spikes were obtained by sampling ambient air through the previously spiked cartridges and are collocated with an ambient sample at the "urban background" sampling site. The extraction and analysis of laboratory, trip and field spikes normally occurs at the same time. Laboratory, trip and field spikes for the application and ambient studies were prepared by Evaluation Section staff.

1) Laboratory Spikes: The laboratory spike results for the application study are listed in Table 10. Each of the spike cartridges was spiked with 300 ng of atrazine. The average recovery for atrazine for the application lab spikes was 92%. The laboratory spike results for the ambient study are listed in Table 13. Each of the spike cartridges was spiked with 300 ng of atrazine. The average recovery for atrazine for the ambient lab spikes was 93%.

2) Trip Spikes: The trip spike results for the application and ambient studies are listed in Tables 11 and 14 respectively. Each of the cartridges was spiked with 300 ng of atrazine. The average recoveries for atrazine for the application trip spikes was 96% and for the ambient trip spikes was 101%. These results are consistent with the lab spike results and indicate that the sample transport, storage and analytical procedures used in this study produce acceptable results for atrazine.

3) Field Spikes: Field spikes were originally started on June 1, 2000 (field log numbers 54 and 57) at the ARB Sacramento site. However, sometime after the start of the field spike sampling an unknown person reversed two of the spiked cartridges in the sampling trains (e.g., the 2 cartridges were removed from the sampling train, turned around and put back in the train). The "vandalism" was noticed during the sampling period and the two reversed spike samples were invalidated. Two more field spike samples were run on June 3, 2000 (log numbers 69 and 70). The field spike results for the application and ambient studies are listed in Tables 12 and 15 respectively. Each of the cartridges was spiked with 300 ng of atrazine. The average recovery for atrazine for the application field spikes was 95% and for the ambient field spikes was 91%. These results are consistent with the lab and trip spike results and indicate that the sampling, sample transport, storage and analytical procedures used in this study produce acceptable results for atrazine.

Figure 1

(use map provided by DPR)

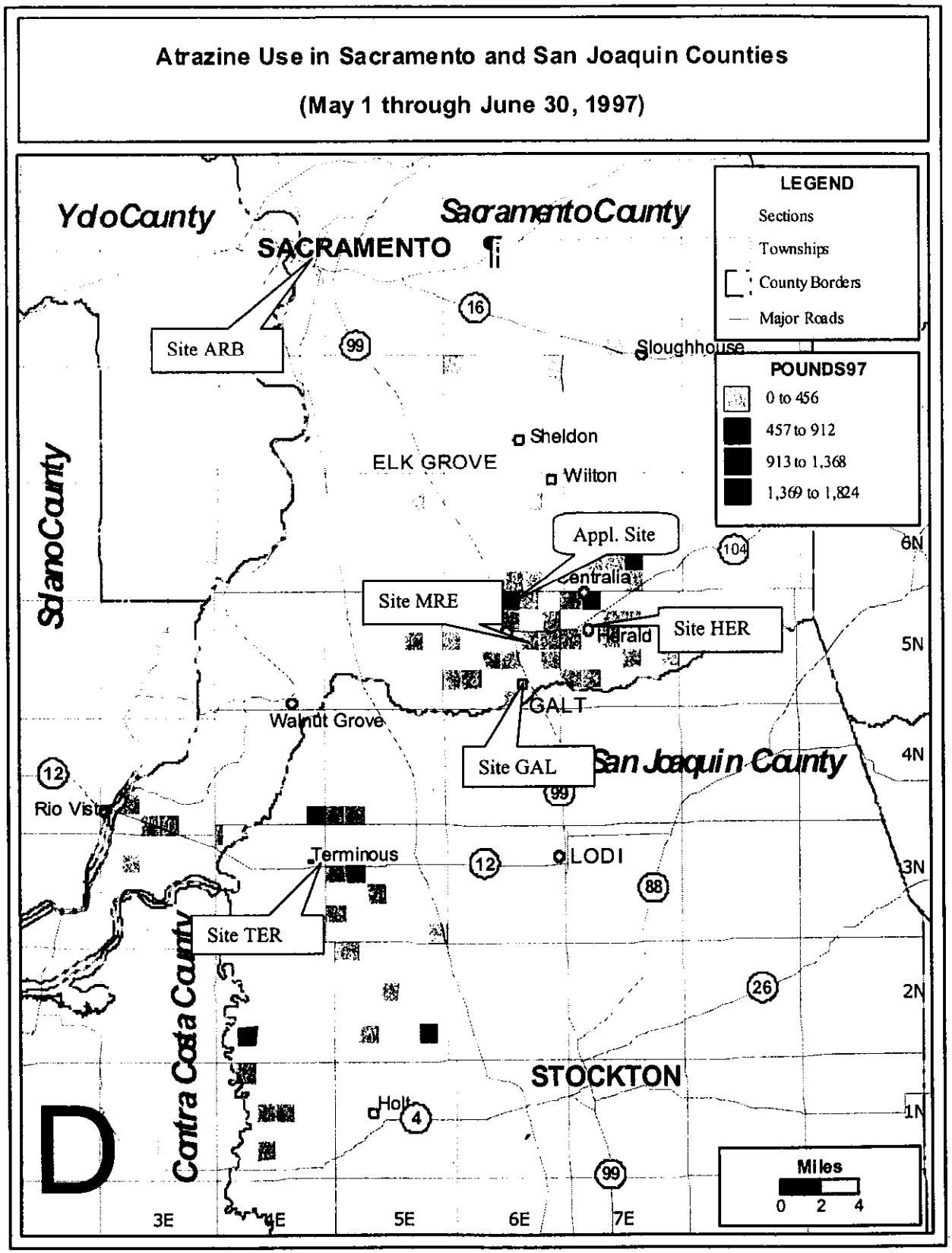


Figure 2
Atrazine Application Area

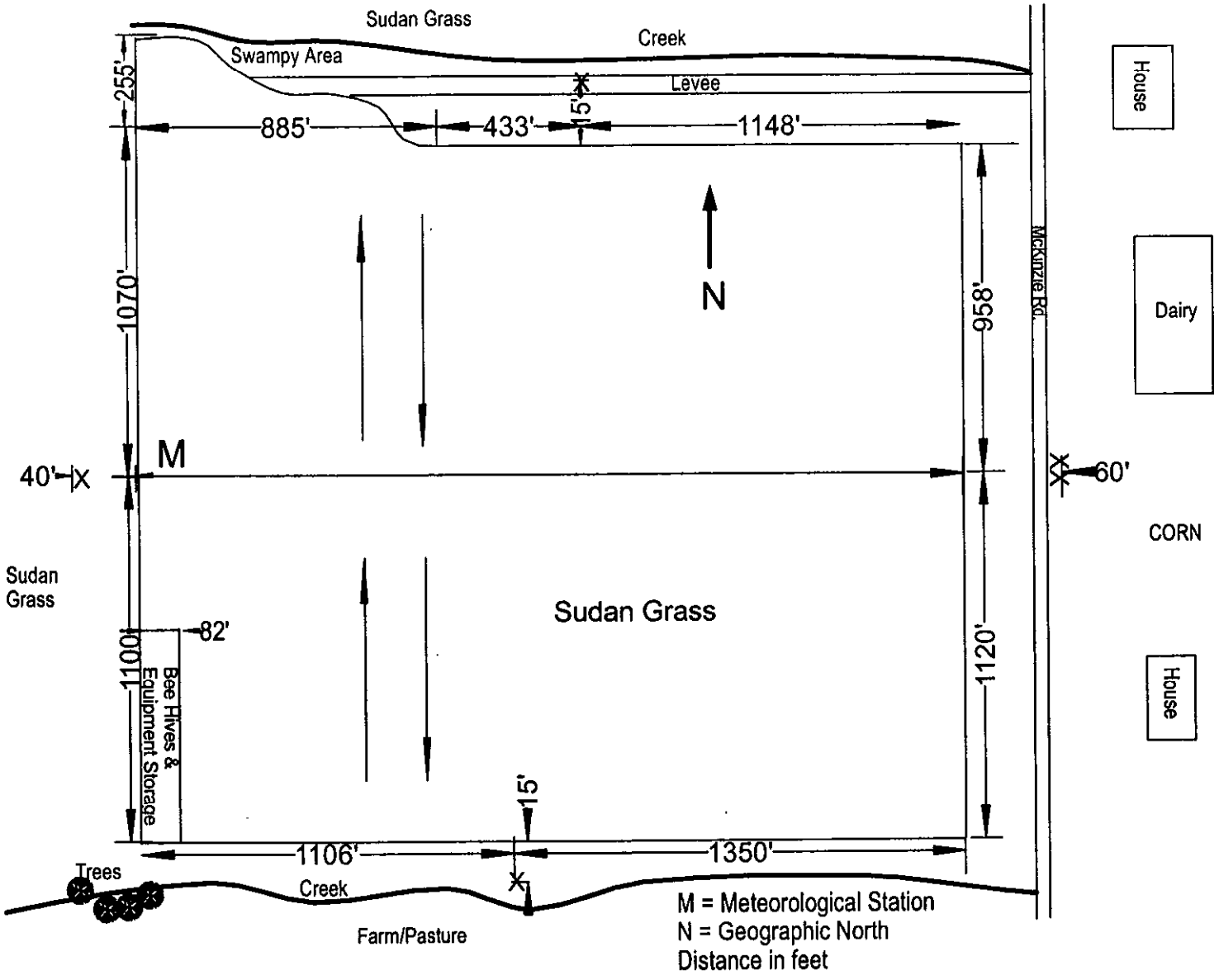


FIGURE 3.

Sample Tree

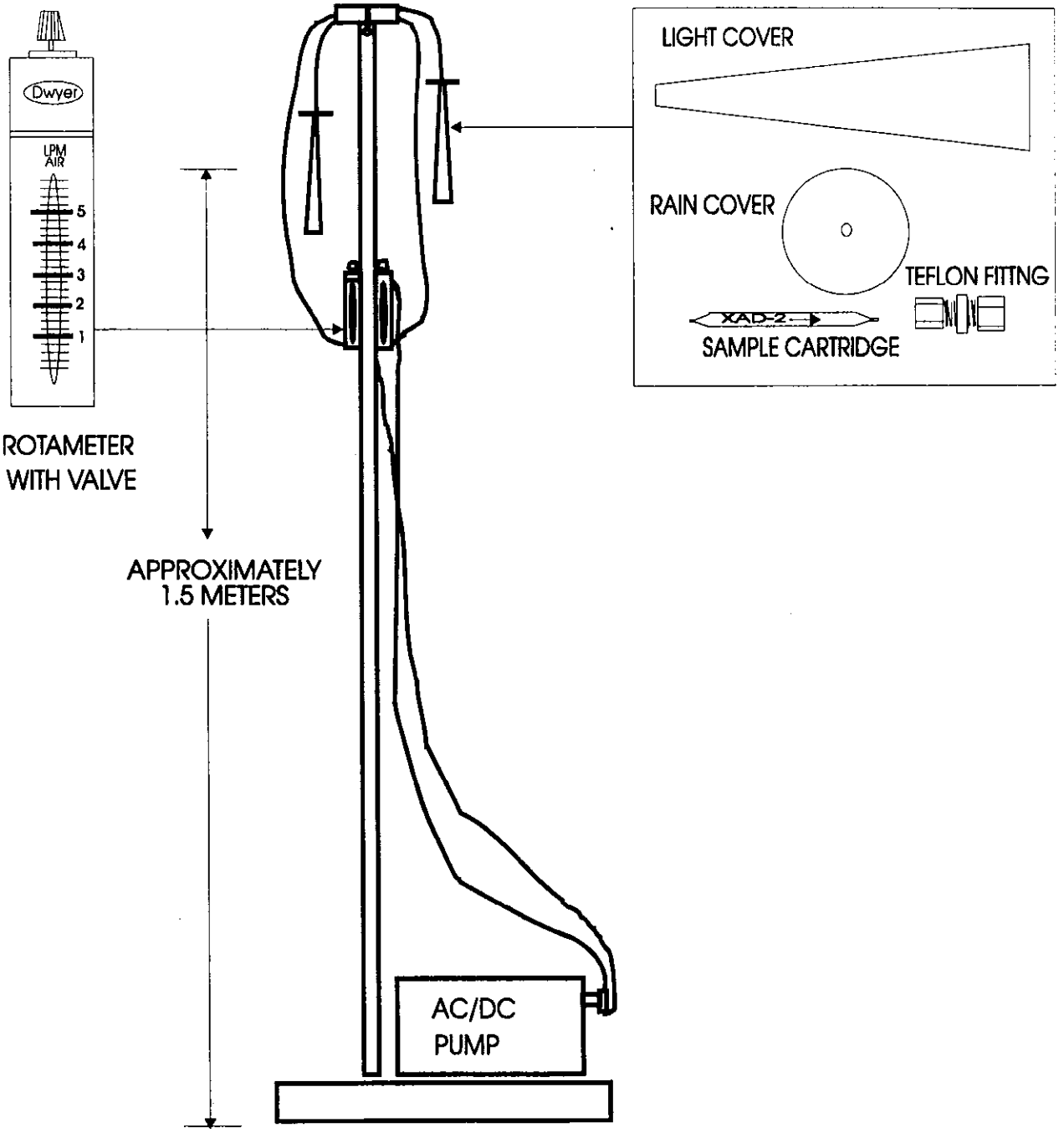


Table 4. Atrazine Application Monitoring Results

Log-#	Sample ID	Start Date/Time	End Date/Time	Sample Time (min.)	Sample Time (hours)	Sample Volume (m3)	Atrazine Sample Results		
							ng/sample	(ng/m3)	*(pptv)
1	NB	06/08/99 1010	06/09/99 1010	1440	24.0	4.3	Det	Det	Det
3	SB	06/08/99 1030	06/09/99 1030	1440	24.0	4.3	Det	Det	Det
5	WB	06/08/99 1040	06/09/99 1040	1440	24.0	4.3	Det	Det	Det
7	EB	06/08/99 1045	06/09/99 1045	1440	24.0	4.3	4.64E+2	1.1E+02	1.2E+01
13	S1	06/10/99 0640	06/10/99 0830	110	1.8	0.3	Det	Det	Det
14	E1	06/10/99 0645	06/10/99 0835	110	1.8	0.3	Det	Det	Det
15	E1D	06/10/99 0645	06/10/99 0835	110	1.8	0.3	Det	Det	Det
16	W1	06/10/99 0655	06/10/99 0840	105	1.7	0.3	<MDL	<MDL	<MDL
17	N1	06/10/99 0700	06/10/99 0845	105	1.8	0.3	Det	Det	Det
18	S2	06/10/99 0830	06/10/99 0930	60	1.0	0.2	<MDL	<MDL	<MDL
19	E2	06/10/99 0835	06/10/99 0935	60	1.0	0.2	5.21E+1	2.9E+02	3.3E+01
20	E2D	06/10/99 0835	06/10/99 0935	60	1.0	0.2	2.70E+1	1.5E+02	1.7E+01
21	W2	06/10/99 0840	06/10/99 0940	60	1.0	0.2	<MDL	<MDL	<MDL
22	N2	06/10/99 0845	06/10/99 0945	60	1.0	0.2	<MDL	<MDL	<MDL
23	S3	06/10/99 0930	06/10/99 1130	120	2.0	0.4	Det	Det	Det
24	E3	06/10/99 0935	06/10/99 1135	120	2.0	0.4	Det	Det	Det
25	E3D	06/10/99 0935	06/10/99 1135	120	2.0	0.4	Det	Det	Det
26	W3	06/10/99 0940	06/10/99 1140	120	2.0	0.4	Det	Det	Det
27	N3	06/10/99 0945	06/10/99 1145	120	2.0	0.4	<MDL	<MDL	<MDL
28	S4	06/10/99 1130	06/10/99 1530	240	4.0	0.7	7.37E+1	1.0E+02	1.2E+01
29	E4	06/10/99 1135	06/10/99 1535	240	4.0	0.7	7.44E+1	1.0E+02	1.2E+01
30	E4D	06/10/99 1135	06/10/99 1535	240	4.0	0.7	7.47E+1	1.0E+02	1.2E+01
31	W4	06/10/99 1140	06/10/99 1540	240	4.0	0.7	Det	Det	Det
32	N4	06/10/99 1145	06/10/99 1545	240	4.0	0.7	3.16E+1	4.4E+01	5.0E+00
33	S5	06/10/99 1530	06/10/99 1945	255	4.2	0.8	2.83E+1	3.7E+01	4.2E+00
34	E5	06/10/99 1535	06/10/99 1950	255	4.3	0.8	1.69E+2	2.2E+02	2.5E+01
35	E5D	06/10/99 1535	06/10/99 1950	255	4.3	0.8	8.77E+1	1.1E+02	1.3E+01
36	W5	06/10/99 1540	06/10/99 1955	255	4.2	0.6	Det	Det	Det

MDL = 4.41 ng/sample

Det = <EQL of 22.0 ng/sample but ≥MDL

*pptv at 1 atm and 25 C

NA = Not Applicable

Table 4. Atrazine Application Monitoring Results

Log-#	Sample ID	Start Date/Time	End Date/Time	Sample Time (min.)	Sample Time (hours)	Sample Volume (m3)	Atrazine Sample Results		
							ng/sample	(ng/m3)	*(pptv)
37	N5	06/10/99 1545	06/10/99 2000	255	4.3	0.8	3.96E+1	5.2E+01	5.9E+00
38	S6	06/10/99 1945	NA	NA	NA	NA	NA	NA	NA
39	E6	06/10/99 1950	06/11/99 0730	700	11.7	2.1	3.72E+1	1.8E+01	2.0E+00
40	E6D	06/10/99 1950	06/11/99 0730	700	11.7	2.1	4.61E+1	2.2E+01	2.5E+00
41	W6	06/10/99 1955	06/11/99 0715	680	11.3	2.0	3.10E+1	1.5E+01	1.7E+00
42	N6	06/10/99 2000	06/11/99 0720	680	11.3	2.0	<MDL	<MDL	<MDL
43	S7	06/11/99 0700	06/11/99 2000	780	13.0	2.3	Det	Det	Det
44	E7	06/11/99 0730	06/11/99 2015	765	12.8	2.3	8.22E+1	3.6E+01	4.1E+00
45	E7D	06/11/99 0730	06/11/99 2015	765	12.8	2.3	7.76E+1	3.4E+01	3.8E+00
46	W7	06/11/99 0715	06/11/99 2020	785	13.1	2.4	3.75E+1	1.6E+01	1.8E+00
47	N7	06/11/99 0720	06/11/99 2030	790	13.2	2.4	<MDL	<MDL	<MDL
48	S8	06/11/99 2000	06/12/99 0700	660	11.0	2.0	Det	Det	Det
49	E8	06/11/99 2015	06/12/99 0715	660	11.0	2.0	Det	Det	Det
50	E8D	06/11/99 2015	06/12/99 0715	660	11.0	2.0	Det	Det	Det
51	W8	06/11/99 2020	06/12/99 0720	660	11.0	2.0	3.43E+1	1.7E+01	2.0E+00
52	N8	06/11/99 2030	06/12/99 0730	660	11.0	2.0	4.12E+1	2.1E+01	2.4E+00
53	S9	06/12/99 0700	06/13/99 0700	1440	24.0	4.3	Det	Det	Det
54	E9	06/12/99 0715	06/13/99 0715	1440	24.0	4.3	1.17E+2	2.7E+01	3.1E+00
55	E9D	06/12/99 0715	06/13/99 0715	1440	24.0	4.0	1.15E+2	2.9E+01	3.3E+00
56	W9	06/12/99 0720	06/13/99 0720	1440	24.0	4.3	5.18E+1	1.2E+01	1.4E+00
57	N9	06/12/99 0730	06/13/99 0730	1440	24.0	4.3	1.20E+2	2.8E+01	3.2E+00
58	TB	06/13/99 0730		NA	NA	NA	<MDL	NA	NA

MDL = 4.41 ng/sample
Det = <EQL of 22.0 ng/sample but ≥MDL
*pptv at 1 atm and 25 C
NA = Not Applicable

Table 5. Summary of Atrazine Application Results (ng/m3)

Sampling Period	Hours Sampled	South	North	West	East	East Collocated
Background	24	Det	Det	Det	11	NA
1	1 3/4	Det	Det	<MDL	Det	Det
2	1	<MDL	<MDL	<MDL	290	150
3	2	Det	<MDL	Det	Det	Det
4	4	100	44	Det	100	100
5	4 1/4	37	52	Det	220	110
6	11 1/2	NA	<MDL	15	18	22
7	13	Det	<MDL	16	36	34
8	11	Det	21	17	Det	Det
9	24	Det	28	12	27	27

MDL = 4.41 ng/sample
Det = <EQL of 22.0 ng/sample but ≥MDL
NA = Not Applicable

Table 6. Atrazine Application Collocated Results

Sample ID	Atrazine Sample Results (ng/m3)	Average	Relative Difference
E1	Det		
E1D	Det	NA	NA
E2	290		
E2D	150	220	64%
E3	Det		
E3D	Det	Det	NA
E4	100		
E4D	100	100	0%
E5	220		
E5D	110	165	67%
E6	18		
E6D	22	20	20%
E7	36		
E7D	34	35	5.7%
E8	Det		
E8D	Det	Det	NA
E9	27		
E9D	27	11.6	0%

MDL = 4.41 ng/sample
Det = <EQL of 22.0 ng/sample but ≥MDL
NA = Not Applicable

Table 7. Atrazine Ambient Monitoring Results

Log-#	Sample ID	Start Date/Time	End Date/Time	Sample Time (min.)	Sample Time (hours)	Sample Volume (m3)	Atrazine Sample Results		
							ng/sample	(ng/m3)	*(pptv)
1	ARB1	05/17/99 0915	05/18/99 0915	1440	24.0	4.3	<MDL	<MDL	<MDL
2	HER1	05/17/99 1000	05/18/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
3	MRE1	05/17/99 1016	05/18/99 1016	1440	24.0	4.3	Det	Det	Det
4	GAL1	05/17/99 1035	05/18/99 1035	1440	24.0	4.3	<MDL	<MDL	<MDL
5	TER1	05/17/99 1120	05/18/99 1120	1440	24.0	4.3	<MDL	<MDL	<MDL
6	ARB2	05/18/99 0915	05/19/99 0915	1440	24.0	4.3	<MDL	<MDL	<MDL
7	HER2	05/18/99 1000	05/19/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
8	MRE2	05/18/99 1016	05/19/99 1016	1440	24.0	4.3	<MDL	<MDL	<MDL
9	GAL2	05/18/99 1035	05/19/99 1035	1440	24.0	4.3	<MDL	<MDL	<MDL
10	TER2	05/18/99 1120	05/19/99 1120	1440	24.0	4.3	<MDL	<MDL	<MDL
11	ARB3	05/19/99 0915	05/20/99 0915	1440	24.0	4.3	<MDL	<MDL	<MDL
12	ARB3D	05/19/99 0915	05/20/99 0915	1440	24.0	4.3	<MDL	<MDL	<MDL
13	HER3	05/19/99 1000	05/20/99 1000	1440	24.0	4.3	Det	Det	Det
14	HER3D	05/19/99 1000	05/20/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
15	MRE3	05/19/99 1016	05/20/99 1016	1440	24.0	4.3	Det	Det	Det
16	MRE3D	05/19/99 1016	05/20/99 1016	1440	24.0	4.3	Det	Det	Det
17	GAL3	05/19/99 1035	05/20/99 1035	1440	24.0	4.3	<MDL	<MDL	<MDL
18	GAL3D	05/19/99 1035	05/20/99 1035	1440	24.0	4.3	<MDL	<MDL	<MDL
19	TER3	05/19/99 1120	05/20/99 1120	1440	24.0	4.3	<MDL	<MDL	<MDL
20	TER3D	05/19/99 1120	05/20/99 1120	1440	24.0	4.3	<MDL	<MDL	<MDL
21	ARB4	05/20/99 0915	05/21/99 0915	1440	24.0	4.3	<MDL	<MDL	<MDL
22	HER4	05/20/99 1000	05/21/99 1000	1440	24.0	4.3	Det	Det	Det
23	MRE4	05/20/99 1016	05/21/99 1016	1440	24.0	4.3	Det	Det	Det
24	GAL4	05/20/99 1035	05/21/99 1035	1440	24.0	4.3	Det	Det	Det
25	TER4	05/20/99 1120	05/21/99 1120	1440	24.0	4.3	<MDL	<MDL	<MDL
26	ARB5	05/24/99 0900	05/25/99 0900	1440	24.0	4.3	<MDL	<MDL	<MDL
27	HER5	05/24/99 0945	05/25/99 0945	1440	24.0	4.3	Det	Det	Det

MDL = 4.41 ng/sample
Det = <EQL of 22.0 ng/sample but ≥MDL
*pptv at 1 atm and 25 C
NA = Not Applicable

Table 7. Atrazine Ambient Monitoring Results

Log-#	Sample ID	Start Date/Time	End Date/Time	Sample Time (min.)	Sample Time (hours)	Sample Volume (m3)	Atrazine Sample Results		
							ng/sample	(ng/m3)	*(pptv)
28	MRE5	05/24/99 1000	05/25/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
29	GAL5	05/24/99 1020	05/25/99 1020	1440	24.0	4.3	Det	Det	Det
30	TER5	05/24/99 1105	05/25/99 1105	1440	24.0	4.3	<MDL	<MDL	<MDL
31	ARB6	05/25/99 0900	05/26/99 0900	1440	24.0	4.3	<MDL	<MDL	<MDL
32	HER6	05/25/99 0945	05/26/99 0945	1440	24.0	4.3	Det	Det	Det
33	MRE6	05/25/99 1000	05/26/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
34	GAL6	05/25/99 1020	05/26/99 1020	1440	24.0	4.3	Det	Det	Det
35	TER6	05/25/99 1105	05/26/99 1105	1440	24.0	4.3	<MDL	<MDL	<MDL
36	ARB7	05/26/99 0900	05/27/99 0900	1440	24.0	4.3	<MDL	<MDL	<MDL
37	ARB7D	05/26/99 0900	05/27/99 0900	1440	24.0	4.3	<MDL	<MDL	<MDL
38	BLANK		05/27/99 0900	NA	NA	NA	<MDL	NA	NA
39	HER7	05/26/99 0945	05/27/99 0945	1440	24.0	4.3	Det	Det	Det
40	HER7D	05/26/99 0945	05/27/99 0945	1440	24.0	4.3	Det	Det	Det
41	MRE7	05/26/99 1000	05/27/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
42	MRE7D	05/26/99 1000	05/27/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
43	GAL7	05/26/99 1020	05/27/99 1020	1440	24.0	4.3	Det	Det	Det
44	GAL7D	05/26/99 1020	05/27/99 1020	1440	24.0	4.3	Det	Det	Det
45	TER7	05/26/99 1105	05/27/99 1105	1440	24.0	4.3	<MDL	<MDL	<MDL
46	TER7D	05/26/99 1105	05/27/99 1105	1440	24.0	4.3	<MDL	<MDL	<MDL
47	ARB8	05/27/99 0900	05/28/99 0900	1440	24.0	4.3	<MDL	<MDL	<MDL
48	HER8	05/27/99 0945	05/28/99 0945	1440	24.0	4.3	Det	Det	Det
49	MRE8	05/27/99 1000	05/28/99 1000	1440	24.0	4.3	Det	Det	Det
50	GAL8	05/27/99 1020	05/28/99 1020	1440	24.0	4.3	<MDL	<MDL	<MDL
51	TER8	05/27/99 1105	05/28/99 1105	1440	24.0	4.3	<MDL	<MDL	<MDL
52	ARB9	06/01/99 1015	06/02/99 1015	1440	24.0	4.3	<MDL	<MDL	<MDL
53	BLANK	06/01/99 1015		NA	NA	NA	<MDL	NA	NA
58	HER9	06/01/99 1115	06/02/99 1135	1460	24.3	4.4	<MDL	<MDL	<MDL

MDL = 4.41 ng/sample
Det = <EQL of 22.0 ng/sample but ≥MDL
*pptv at 1 atm and 25 C
NA = Not Applicable

Table 7. Atrazine Ambient Monitoring Results

Log-#	Sample ID	Start Date/Time	End Date/Time	Sample Time (min.)	Sample Time (hours)	Sample Volume (m3)	Atrazine Sample Results		
							ng/sample	(ng/m3)	*(pptv)
59	MRE9	06/01/99 1135	06/02/99 1150	1455	24.2	4.4	<MDL	<MDL	<MDL
60	GAL9	06/01/99 1145	06/02/99 1200	1455	24.2	4.4	<MDL	<MDL	<MDL
61	TER9	06/01/99 1215	06/02/99 1255	1480	24.7	4.4	<MDL	<MDL	<MDL
62	ARB10	06/02/99 1015	06/03/99 1015	1440	24.0	4.3	<MDL	<MDL	<MDL
63	HER10	06/02/99 1135	06/03/99 1135	1440	24.0	4.3	Det	Det	Det
64	MRE10	06/02/99 1150	06/03/99 1150	1440	24.0	4.3	Det	Det	Det
65	GAL10	06/02/99 1200	06/03/99 1200	1440	24.0	4.3	<MDL	<MDL	<MDL
66	TER10	06/02/99 1255	06/03/99 1255	1440	24.0	4.3	<MDL	<MDL	<MDL
67	ARB11	06/03/99 1015	06/04/99 1015	1440	24.0	4.3	<MDL	<MDL	<MDL
68	ARB11D	06/03/99 1015	06/04/99 1015	1440	24.0	4.3	<MDL	<MDL	<MDL
71	HER11	06/03/99 1135	06/04/99 1135	1440	24.0	4.3	Det	Det	Det
72	HER11D	06/03/99 1135	06/04/99 1135	1440	24.0	4.3	Det	Det	Det
73	MRE11	06/03/99 1150	06/04/99 1150	1440	24.0	4.3	<MDL	<MDL	<MDL
74	MRE11D	06/03/99 1150	06/04/99 1150	1440	24.0	4.3	<MDL	<MDL	<MDL
75	GAL11	06/03/99 1200	06/04/99 1200	1440	24.0	4.3	<MDL	<MDL	<MDL
76	GAL11D	06/03/99 1200	06/04/99 1200	1440	24.0	4.3	<MDL	<MDL	<MDL
77	TER11	06/03/99 1255	06/04/99 1255	1440	24.0	4.3	<MDL	<MDL	<MDL
78	TER11D	06/03/99 1255	06/04/99 1255	1440	24.0	4.3	<MDL	<MDL	<MDL
83	ARB12	06/07/99 1000	06/08/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
84	HER12	06/07/99 1100	06/08/99 1100	1440	24.0	4.3	Det	Det	Det
85	MRE12	06/07/99 1120	06/08/99 1120	1440	24.0	4.3	<MDL	<MDL	<MDL
86	GAL12	06/07/99 1140	06/08/99 1140	1440	24.0	4.3	<MDL	<MDL	<MDL
87	TER12	06/07/99 1230	06/08/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
88	BLANK		06/08/99 1000	NA	NA	NA	<MDL	NA	NA
89	ARB13	06/08/99 1000	06/09/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
90	HER13	06/08/99 1100	06/09/99 1100	1440	24.0	4.3	Det	Det	Det
91	MRE13	06/08/99 1120	06/09/99 1120	1440	24.0	4.3	Det	Det	Det

MDL = 4.41 ng/sample

Det = <EQL of 22.0 ng/sample but ≥MDL

*pptv at 1 atm and 25 C

NA = Not Applicable

Table 7. Atrazine Ambient Monitoring Results

Log-#	Sample ID	Start Date/Time	End Date/Time	Sample Time (min.)	Sample Time (hours)	Sample Volume (m3)	Atrazine Sample Results		
							ng/sample	(ng/m3)	*(pptv)
92	GAL13	06/08/99 1145	06/09/99 1145	1440	24.0	4.3	<MDL	<MDL	<MDL
93	TER13	06/08/99 1235	06/09/99 1230	1435	23.9	4.3	<MDL	<MDL	<MDL
94	ARB14	06/09/99 1000	06/10/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
95	ARB14D	06/09/99 1000	06/10/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
96	HER14	06/09/99 1100	06/10/99 1100	1440	24.0	4.0	Det	Det	Det
97	HER14D	06/09/99 1100	06/10/99 1100	1440	24.0	4.0	Det	Det	Det
98	MRE14	06/09/99 1120	06/10/99 1120	1440	24.0	4.3	Det	Det	Det
99	MRE14D	06/09/99 1120	06/10/99 1120	1440	24.0	4.3	Det	Det	Det
100	GAL14	06/09/99 1145	06/10/99 1145	1440	24.0	4.3	Det	Det	Det
101	GAL14D	06/09/99 1145	06/10/99 1145	1440	24.0	4.3	<MDL	<MDL	<MDL
102	TER14	06/09/99 1230	06/10/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
103	TER14D	06/09/99 1230	06/10/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
104	ARB15	06/10/99 1000	06/11/99 1000	1440	24.0	4.3	Det	Det	Det
105	HER15	06/10/99 1100	06/11/99 1100	1440	24.0	4.3	2.47E+1	5.7E+00	6.5E-01
106	MRE15	06/10/99 1120	06/11/99 1120	1440	24.0	4.3	Det	Det	Det
107	GAL15	06/10/99 1145	06/11/99 1145	1440	24.0	4.3	Det	Det	Det
108	TER15	06/10/99 1230	06/11/99 1130	1380	23.0	4.1	<MDL	<MDL	<MDL
109	ARB16	06/14/99 1000	06/15/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
110	HER16	06/14/99 1050	06/15/99 1050	1440	24.0	4.3	<MDL	<MDL	<MDL
111	MRE16	06/14/99 1100	06/15/99 1100	1440	24.0	4.3	<MDL	<MDL	<MDL
112	GAL16	06/14/99 1115	06/15/99 1115	1440	24.0	4.3	Det	Det	Det
113	TER16	06/14/99 1230	06/15/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
114	ARB17	06/15/99 1000	06/16/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
115	HER17	06/15/99 1050	06/16/99 1050	1440	24.0	4.3	Det	Det	Det
116	MRE17	06/15/99 1100	06/16/99 1100	1440	24.0	4.3	<MDL	<MDL	<MDL
117	GAL17	06/15/99 1115	06/16/99 1115	1440	24.0	4.3	<MDL	<MDL	<MDL
118	TER17	06/15/99 1230	06/16/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL

MDL = 4.41 ng/sample

Det = <EQL of 22.0 ng/sample but ≥MDL

*pptv at 1 atm and 25 C

NA = Not Applicable

Table 7. Atrazine Ambient Monitoring Results

Log-#	Sample ID	Start Date/Time	End Date/Time	Sample Time (min.)	Sample Time (hours)	Sample Volume (m3)	Atrazine Sample Results		
							ng/sample	(ng/m3)	*(pptv)
119	ARB18	06/16/99 1000	06/17/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
120	ARB18D	06/16/99 1000	06/17/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
121	HER18	06/16/99 1050	06/17/99 1050	1440	24.0	4.3	2.06E+1	4.8E+00	5.4E-01
122	HER18D	06/16/99 1050	06/17/99 1050	1440	24.0	4.3	2.47E+1	5.7E+00	6.5E-01
123	MRE18	06/16/99 1100	06/17/99 1100	1440	24.0	4.3	Det	Det	Det
124	MRE18D	06/16/99 1100	06/17/99 1100	1440	24.0	4.3	Det	Det	Det
125	GAL18	06/16/99 1115	06/17/99 1115	1440	24.0	4.3	<MDL	<MDL	<MDL
126	GAL18D	06/16/99 1115	06/17/99 1115	1440	24.0	4.3	Det	Det	Det
127	TER18	06/16/99 1230	06/17/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
128	TER18D	06/16/99 1230	06/17/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
129	BLANK	06/16/99 1230		NA	NA	NA	<MDL	NA	NA
130	ARB19	06/17/99 1000	06/18/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
131	HER19	06/17/99 1050	06/18/99 1050	1440	24.0	4.3	Det	Det	Det
132	MRE19	06/17/99 1100	06/18/99 1100	1440	24.0	4.3	<MDL	<MDL	<MDL
133	GAL19	06/17/99 1115	06/18/99 1115	1440	24.0	4.3	<MDL	<MDL	<MDL
134	TER19	06/17/99 1230	06/18/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
135	ARB20	06/21/99 1000	06/22/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
136	HER20	06/21/99 1050	06/22/99 1050	1440	24.0	4.3	Det	Det	Det
137	MRE20	06/21/99 1100	06/22/99 1100	1440	24.0	4.3	Det	Det	Det
138	GAL20	06/21/99 1115	06/22/99 1115	1440	24.0	4.3	<MDL	<MDL	<MDL
139	TER20	06/21/99 1230	06/22/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
140	ARB21	06/22/99 1000	06/23/99 1000	1440	24.0	4.3	NA	NA	NA
141	HER21	06/22/99 1050	06/23/99 1050	1440	24.0	4.3	Det	Det	Det
142	MRE21	06/22/99 1100	06/23/99 1100	1440	24.0	4.3	Det	Det	Det
143	GAL21	06/22/99 1115	06/23/99 1115	1440	24.0	4.3	2.94E+1	6.8E+00	7.7E-01
144	TER21	06/22/99 1230	06/23/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
145	ARB22	06/23/99 1000	06/24/99 1000	1440	24.0	4.3	Det	Det	Det

MDL = 4.41 ng/sample

Det = <EQL of 22.0 ng/sample but ≥MDL

*pptv at 1 atm and 25 C

NA = Not Applicable

Table 7. Atrazine Ambient Monitoring Results

Log-#	Sample ID	Start Date/Time	End Date/Time	Sample Time (min.)	Sample Time (hours)	Sample Volume (m3)	Atrazine Sample Results		
							ng/sample	(ng/m3)	*(pptv)
146	ARB22D	06/23/99 1000	06/24/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
147	BLANK	06/23/99 1000		NA	NA	NA	<MDL	NA	NA
148	HER22	06/23/99 1050	06/24/99 1050	1440	24.0	4.3	Det	Det	Det
149	HER22D	06/23/99 1050	06/24/99 1050	1440	24.0	4.3	Det	Det	Det
150	MRE22	06/23/99 1100	06/24/99 1100	1440	24.0	4.3	Det	Det	Det
151	MRE22D	06/23/99 1100	06/24/99 1100	1440	24.0	4.3	Det	Det	Det
152	GAL22	06/23/99 1115	06/24/99 1115	1440	24.0	4.3	<MDL	<MDL	<MDL
153	GAL22D	06/23/99 1115	06/24/99 1115	1440	24.0	4.3	Det	Det	Det
154	TER22	06/23/99 1230	06/24/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
155	TER22D	06/23/99 1230	06/24/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
156	ARB23	06/24/99 1000	06/25/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
157	HER23	06/24/99 1050	06/25/99 1050	1440	24.0	4.3	<MDL	<MDL	<MDL
158	MRE23	06/24/99 1100	06/25/99 1100	1440	24.0	4.3	<MDL	<MDL	<MDL
159	GAL23	06/24/99 1115	06/25/99 1115	1440	24.0	4.3	<MDL	<MDL	<MDL
160	TER23	06/24/99 1230	06/25/99 1230	1440	24.0	4.3	<MDL	<MDL	<MDL
161	ARB24	06/28/99 1000	06/29/99 1000	1440	24.0	4.3	<MDL	<MDL	<MDL
162	HER24	06/28/99 1100	06/29/99 1040	1420	23.7	4.3	Det	Det	Det
163	MRE24	06/28/99 1115	06/29/99 1100	1425	23.8	4.3	Det	Det	Det
164	GAL24	06/28/99 1130	06/29/99 1120	1430	23.8	4.3	Det	Det	Det
165	TER24	06/28/99 1250	06/29/99 1250	1440	24.0	4.3	<MDL	<MDL	<MDL
166	BLANK		06/29/99 1250	NA	NA	NA	<MDL	NA	NA

MDL = 4.41 ng/sample
Det = <EQL of 22.0 ng/sample but ≥MDL
*pptv at 1 atm and 25 C
NA = Not Applicable

Table 8. Summary of Atrazine Ambient Results (ng/m3)

Start Date	ARB	GAL	HER	MRE	TER
05/17/99	<MDL	<MDL	<MDL	Det	<MDL
05/18/99	<MDL	<MDL	<MDL	<MDL	<MDL
05/19/99	<MDL	<MDL	Det	Det	<MDL
05/20/99	<MDL	Det	Det	Det	<MDL
05/24/99	<MDL	Det	Det	<MDL	<MDL
05/25/99	<MDL	Det	Det	<MDL	<MDL
05/26/99	<MDL	Det	Det	<MDL	<MDL
05/27/99	<MDL	<MDL	Det	Det	<MDL
06/01/99	<MDL	<MDL	<MDL	<MDL	<MDL
06/02/99	<MDL	<MDL	Det	Det	<MDL
06/03/99	<MDL	<MDL	Det	<MDL	<MDL
06/07/99	<MDL	<MDL	Det	<MDL	<MDL
06/08/99	<MDL	<MDL	Det	Det	<MDL
06/09/99	<MDL	Det	Det	Det	<MDL
06/10/99	Det	Det	5.7	Det	<MDL
06/14/99	<MDL	Det	<MDL	<MDL	<MDL
06/15/99	<MDL	<MDL	Det	<MDL	<MDL
06/16/99	<MDL	Det	5.7	Det	<MDL
06/17/99	<MDL	<MDL	Det	<MDL	<MDL
06/21/99	<MDL	<MDL	Det	Det	<MDL
06/22/99	NA	6.8	Det	Det	<MDL
06/23/99	Det	Det	Det	Det	<MDL
06/24/99	<MDL	<MDL	<MDL	<MDL	<MDL
06/28/99	<MDL	Det	Det	Det	<MDL

Maximum	Det	6.8	5.7	Det	<MDL
Average	1.2	2.1	2.9	2.1	1.0
# Samples	23	24	24	24	24
# >EQL	0	1	2	0	0
# Det	2	10	17	13	0
# <MDL	21	13	5	11	24

Only the higher value of each collocated pair was used to calculate the above statistics.
"Det" results were factored into the average as (MDL+EQL)/2 = 3.1 ng/m3.
<MDL results were factored into the average as MDL/2 = 1.0 ng/m3.
Assume a 4.32 m3 sample volume for the above MDL and EQL..

MDL = 4.41 ng/sample
Det = <EQL of 22.0 ng/sample but ≥MDL
NA = Not Applicable

Table 9. Atrazine Ambient Collocated Results

Sample ID	Atrazine (ng/m3)	Average	Relative Difference
ARB3	<MDL		
ARB3D	<MDL	<MDL	NA
HER3	Det		
HER3D	<MDL	NA	NA
MRE3	Det		
MRE3D	Det	Det	NA
GAL3	<MDL		
GAL3D	<MDL	<MDL	NA
TER3	<MDL		
TER3D	<MDL	<MDL	NA
ARB7	<MDL		
ARB7D	<MDL	<MDL	NA
HER7	Det		
HER7D	Det	Det	NA
MRE7	<MDL		
MRE7D	<MDL	<MDL	NA
GAL7	Det		
GAL7D	Det	Det	NA
TER7	<MDL		
TER7D	<MDL	<MDL	NA
ARB11	<MDL		
ARB11D	<MDL	<MDL	NA
HER11	Det		
HER11D	Det	Det	NA
MRE11	<MDL		
MRE11D	<MDL	<MDL	NA
GAL11	<MDL		
GAL11D	<MDL	<MDL	NA
TER11	<MDL		
TER11D	<MDL	<MDL	NA

Sample ID	Atrazine (ng/m3)	Average	Relative Difference
ARB14	<MDL		
ARB14D	<MDL	<MDL	NA
HER14	Det		
HER14D	Det	Det	NA
MRE14	Det		
MRE14D	Det	Det	NA
GAL14	Det		
GAL14D	<MDL	NA	NA
TER14	<MDL		
TER14D	<MDL	<MDL	NA
ARB18	<MDL		
ARB18D	<MDL	<MDL	NA
HER18	4.8E+00		
HER18D	5.7E+00	5.3E+00	17%
MRE18	Det		
MRE18D	Det	Det	NA
GAL18	<MDL		
GAL18D	Det	NA	NA
TER18	<MDL		
TER18D	<MDL	<MDL	NA
ARB22	Det		
ARB22D	<MDL	NA	NA
HER22	Det		
HER22D	Det	Det	NA
MRE22	Det		
MRE22D	Det	Det	NA
GAL22	<MDL		
GAL22D	Det	NA	NA
TER22	<MDL		
TER22D	<MDL	<MDL	NA

MDL = 4.41 ng/sample; Det = <EQL of 22.0 ng/sample but ≥MDL; NA = Not Applicable

Table 10. Atrazine *Application Lab* Spike Results

Sample ID	Atrazine Amount (ng)	Expected Amount (ng)	Percent Recovery
LS-1	257	300	86%
LS-2	281	300	94%
LS-3	299	300	100%
LS-4	264	300	88%
		Ave.=	92%

Table 11. Atrazine *Application Trip* Spike Results

Sample ID	Atrazine Amount (ng)	Expected Amount (ng)	Percent Recovery
TS-1	265	300	88%
TS-2	303	300	101%
TS-3	280	300	93%
TS-4	305	300	102%
		Ave.=	96%

Table 12. Atrazine *Application Field* Spike Results

Sample ID	Atrazine Amount (ng)	Background* Amount (ng)	Corrected Amount (ng)	Expected Amount (ng)	Percent Recovery
NFS1	323	14.3	309	300	103%
SFS2	299	10.1	289	300	96%
WFS3	262	9.8	252	300	84%
EFS4	333	46.4	287	300	96%
				Ave.=	95%

*Mass of atrazine found in the collocated background sample.

Table 13. Atrazine *Ambient Lab* Spike Results

Sample ID	Atrazine Amount (ng)	Expected Amount (ng)	Percent Recovery
ASS0528-1	283	300	94%
ASS0528-2	284	300	95%
ASS0528-3	286	300	95%
ASS0528-4	267	300	89%
		Ave.=	93%

Table 14. Atrazine *Ambient Trip* Spike Results

Sample ID	Atrazine Amount (ng)	Expected Amount (ng)	Percent Recovery
TS-1	289	300	96%
TS-2	307	300	102%
TS-3	324	300	108%
TS-4	288	300	96%
		Ave.=	101%

Table 15. Atrazine *Ambient Field* Spike Results

Sample ID	Atrazine Amount (ng)	Background* Amount (ng)	Corrected Amount (ng)	Expected Amount (ng)	Percent Recovery
AFS528-1	263	<MDL	263	300	88%
AFS528-2	274	<MDL	274	300	91%
AFS528-3	263	<MDL	263	300	88%
AFS528-4	288	<MDL	288	300	96%
				Ave.=	91%

*Mass of atrazine found in the collocated ambient sample.

Figure 4
Atrazine Application Results (ng/m3)
Background Period

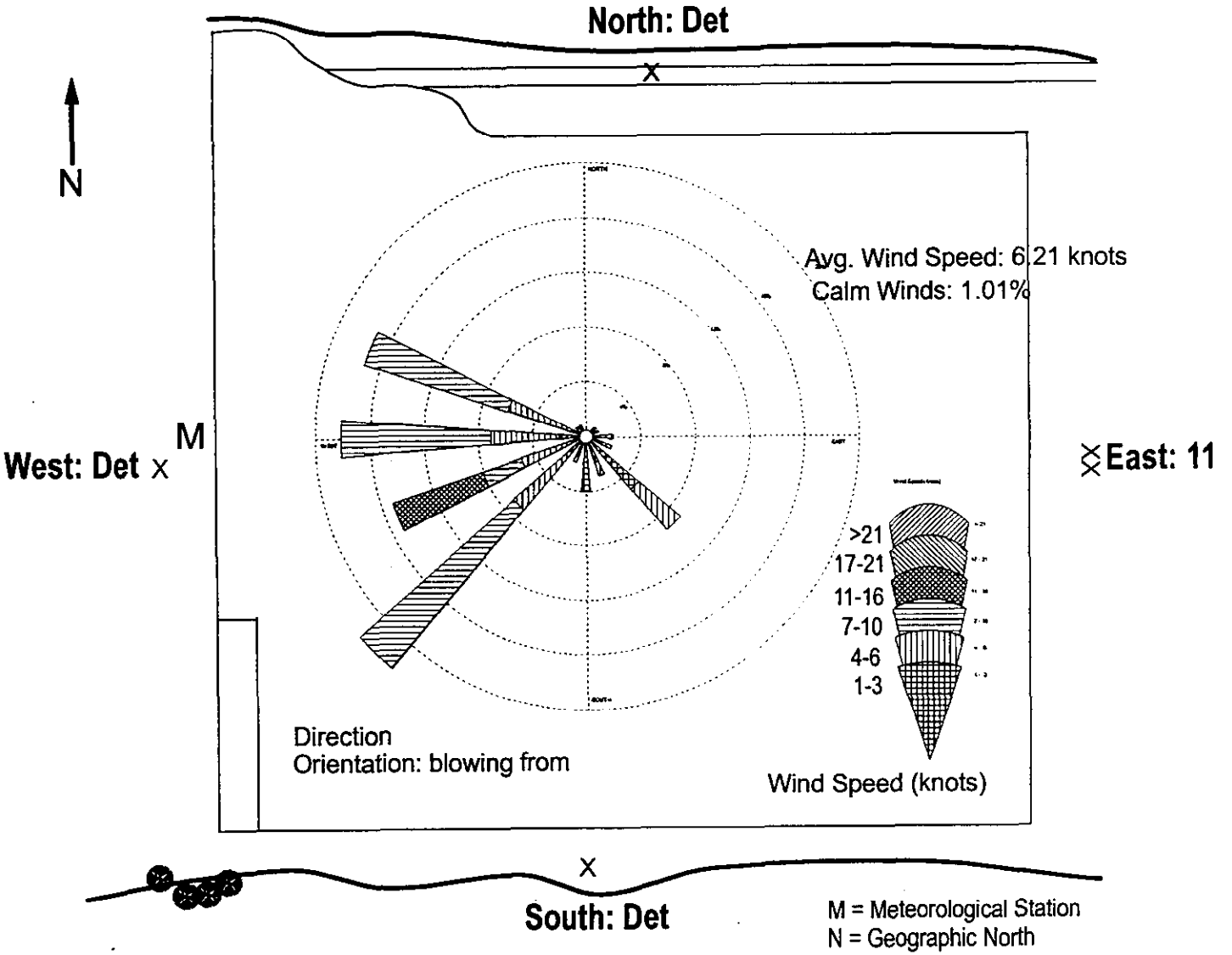


Figure 5
Atrazine Application Results (ng/m3)
Period 1

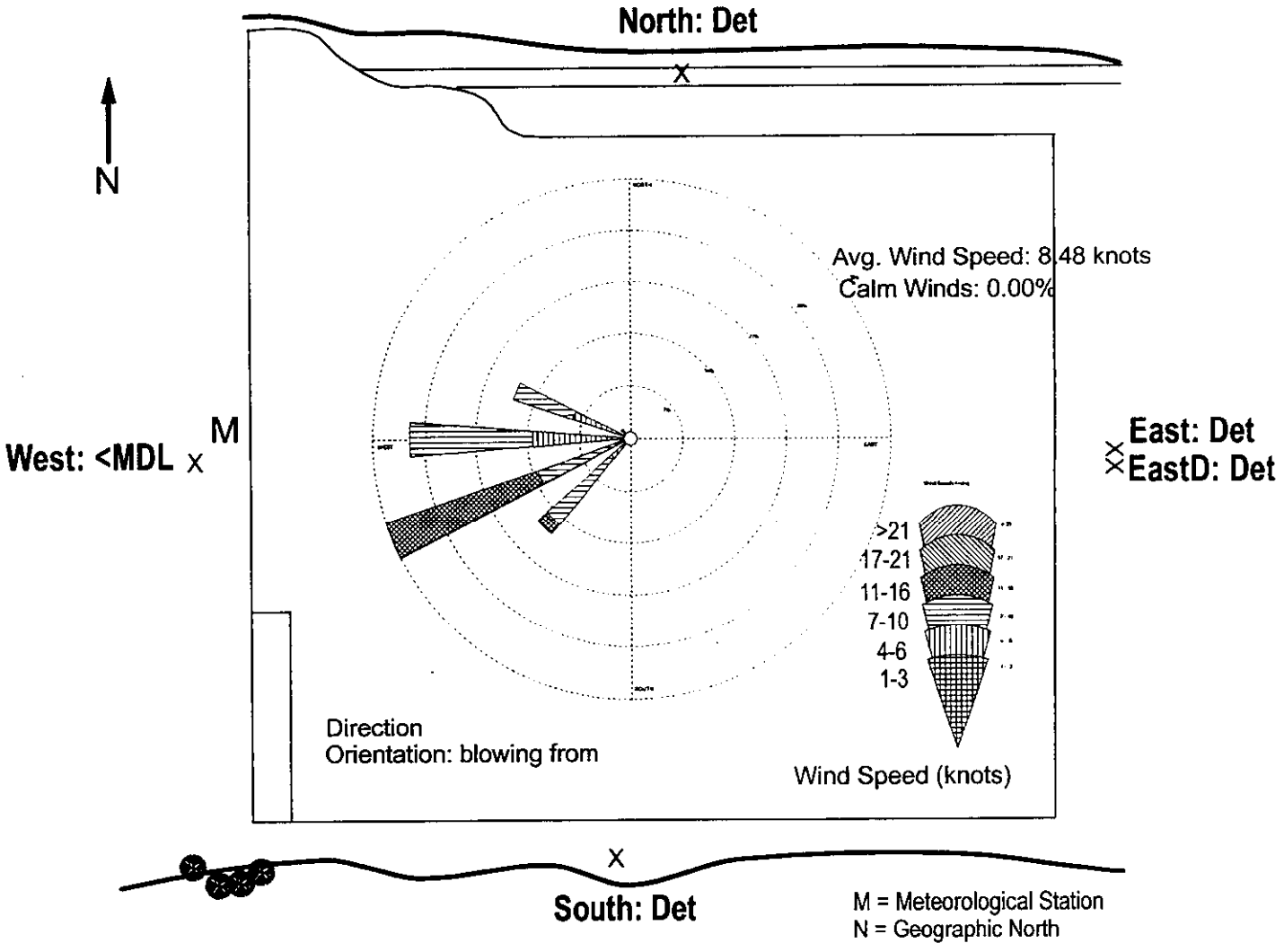


Figure 6
Atrazine Application Results (ng/m3)
Period 2

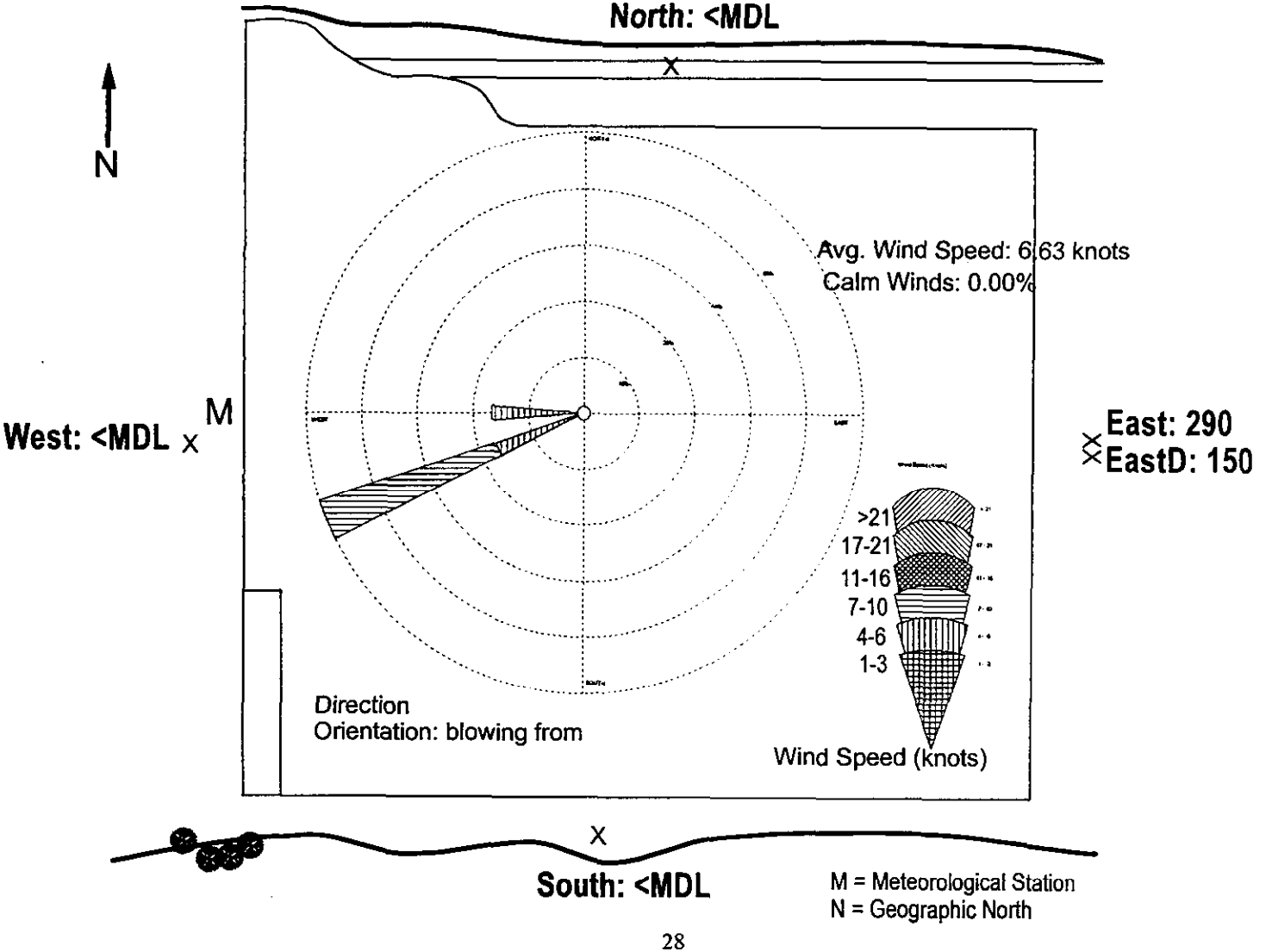


Figure 7
Atrazine Application Results (ng/m3)
Period 3

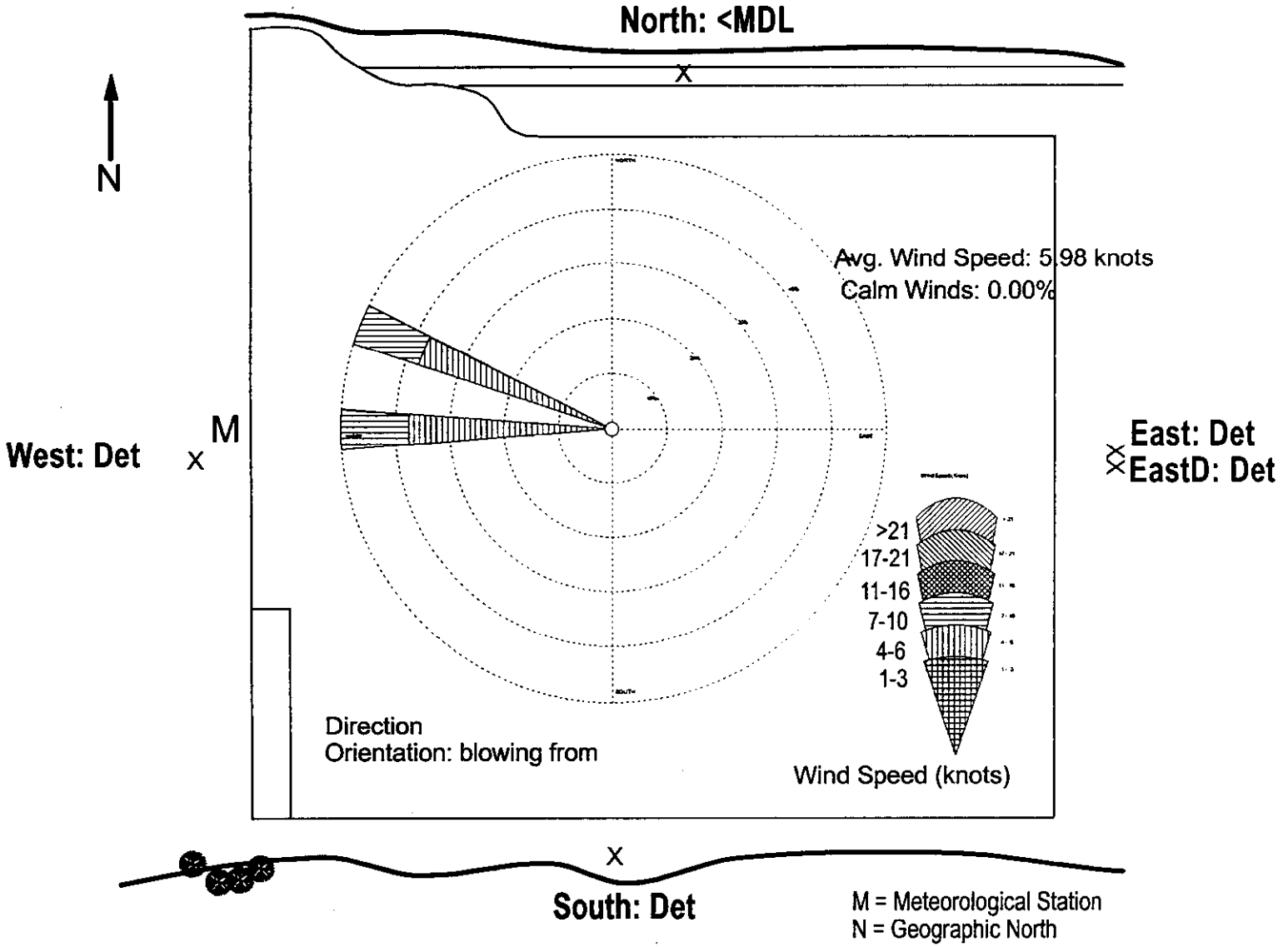


Figure 8
Atrazine Application Results (ng/m3)
Period 4

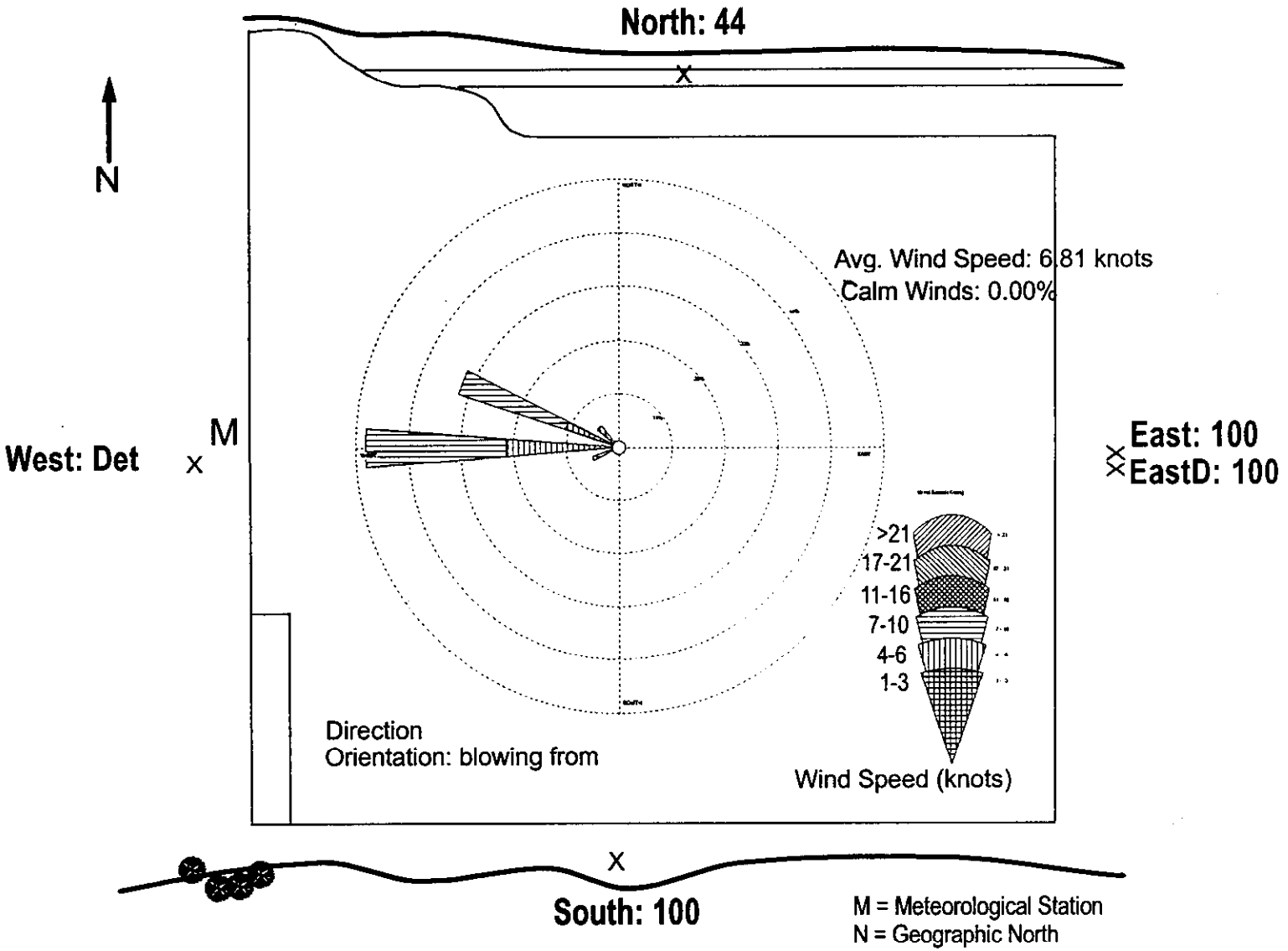


Figure 9
Atrazine Application Results (ng/m3)
Period 5

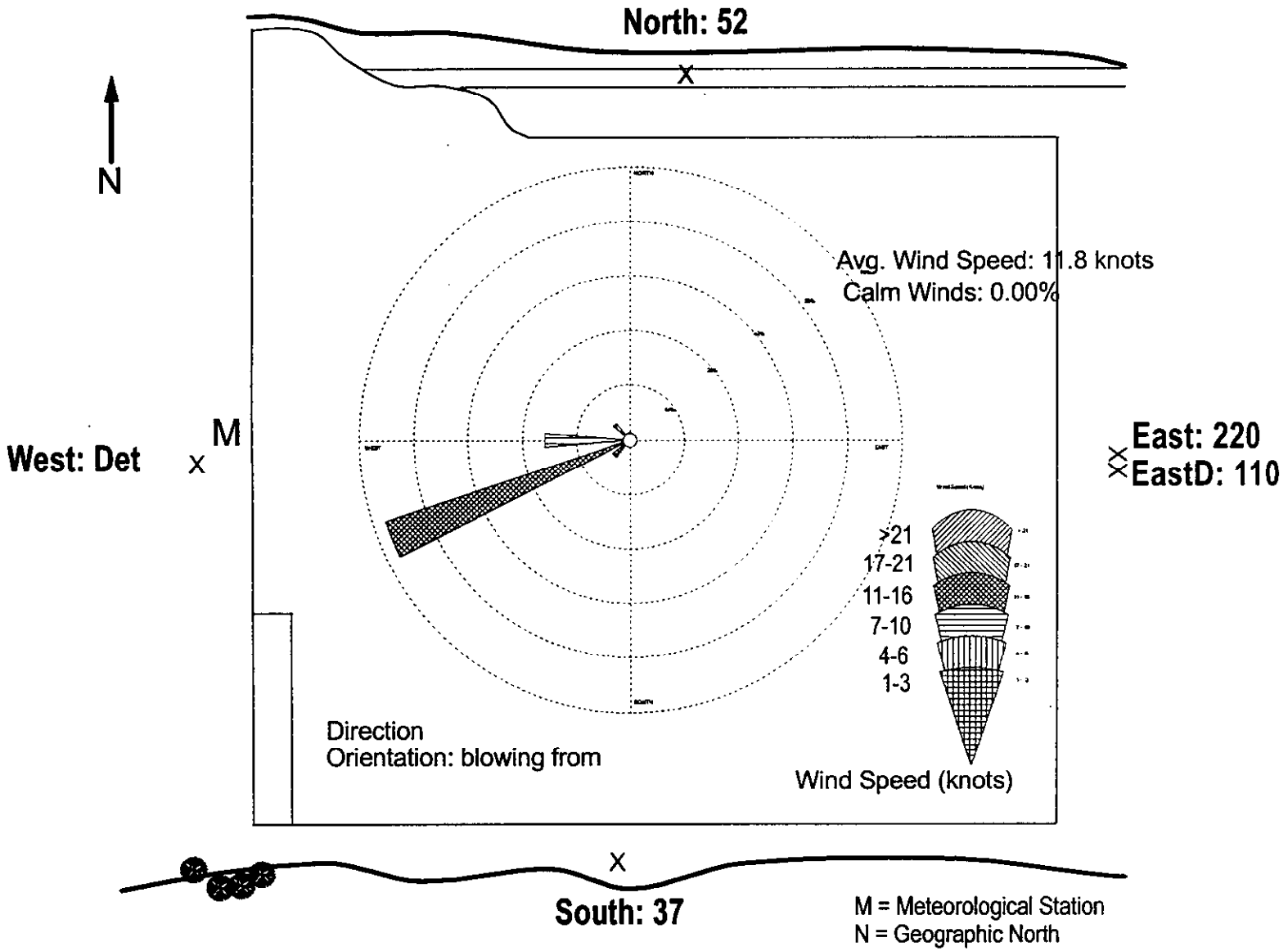


Figure 10
Atrazine Application Results (ng/m3)
Period 6

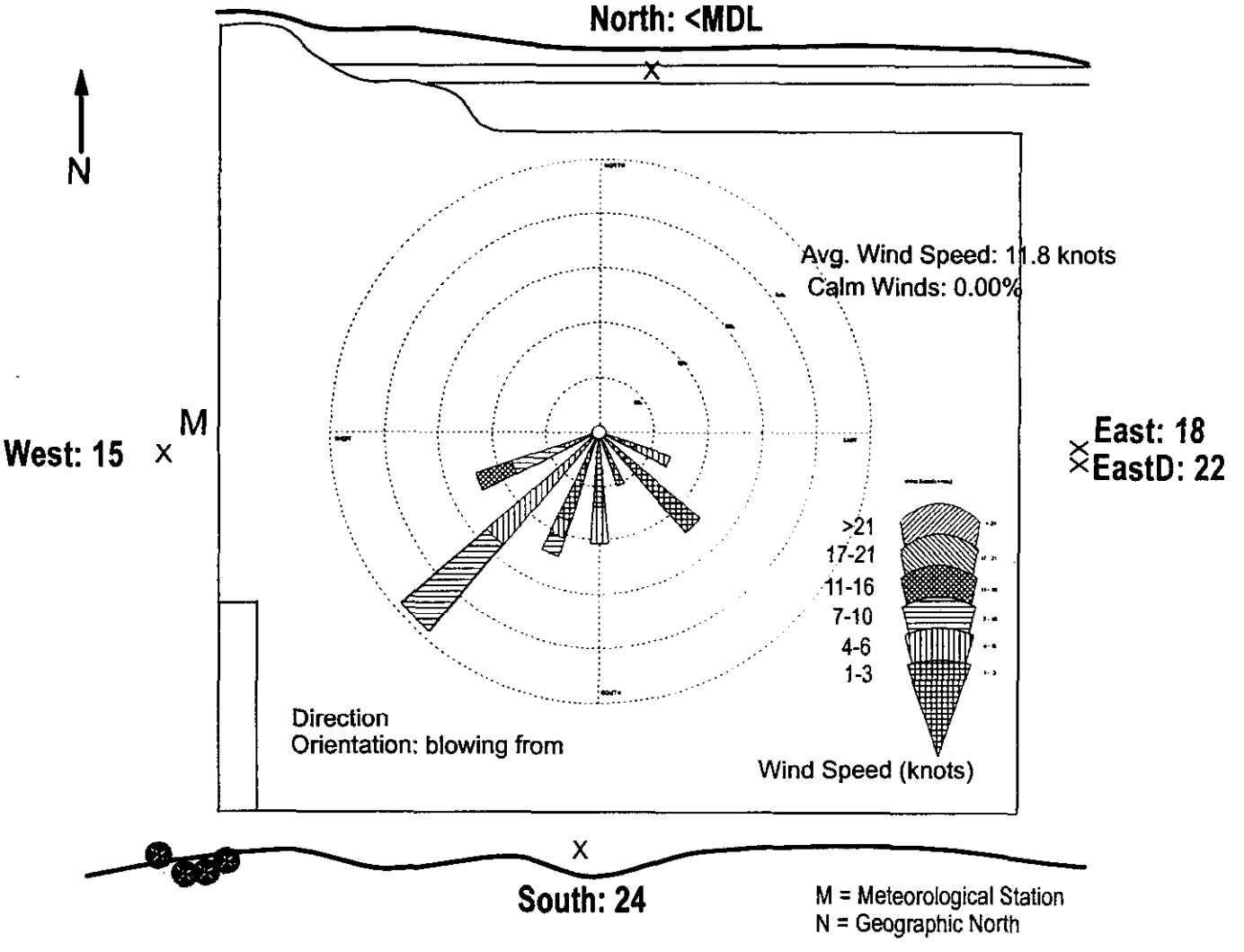


Figure 11
Atrazine Application Results (ng/m3)
Period 7

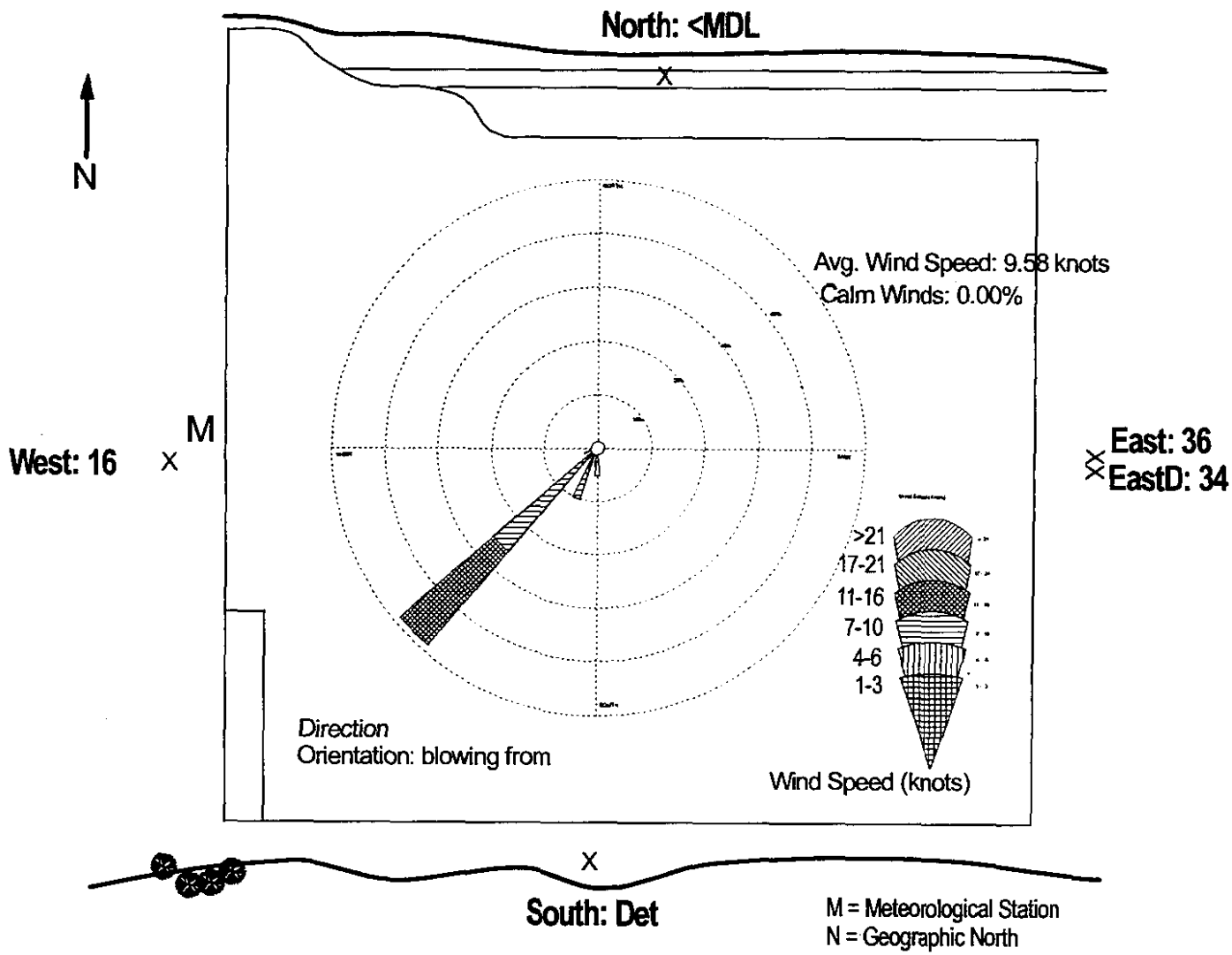


Figure 12
Atrazine Application Results (ng/m3)
Period 8

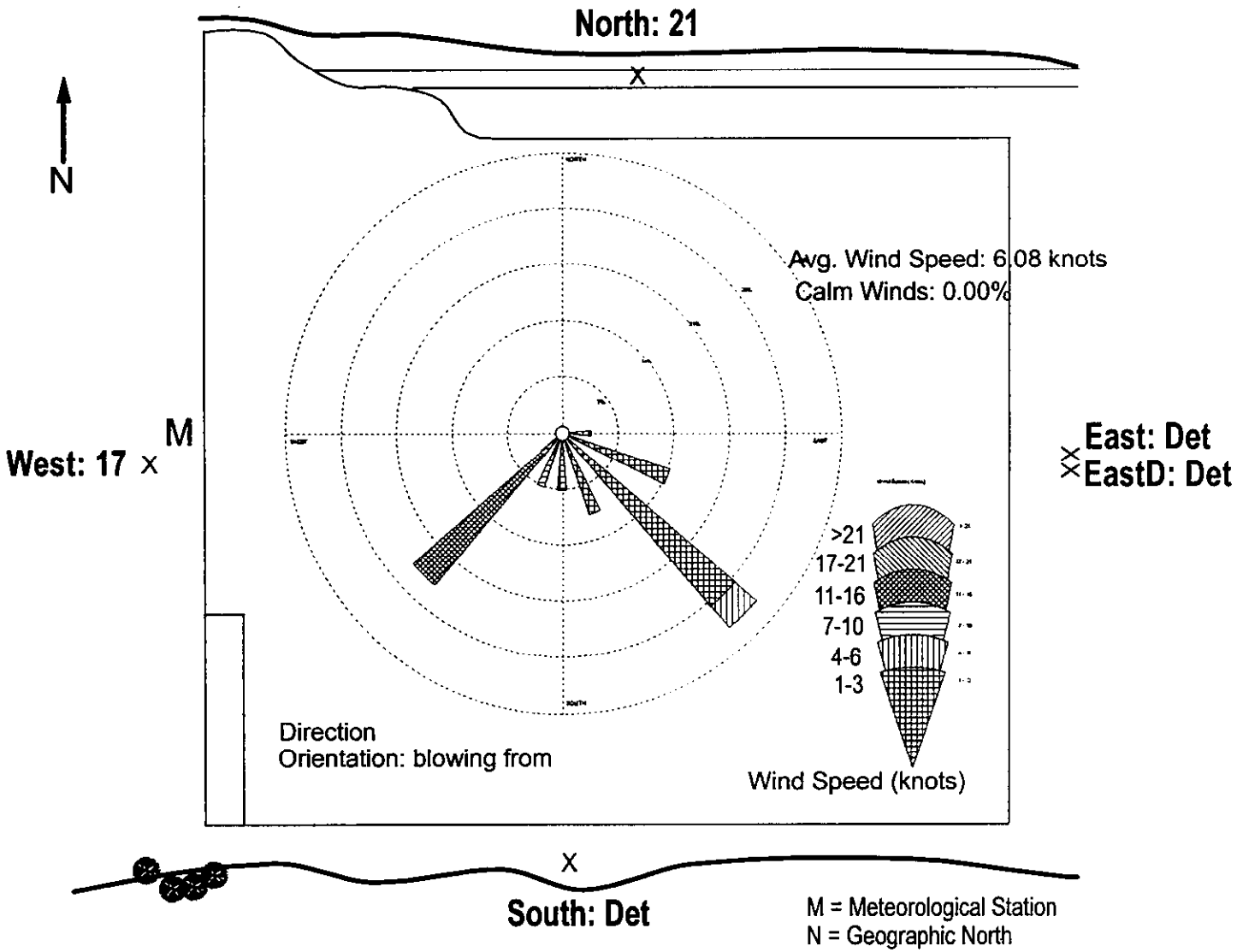
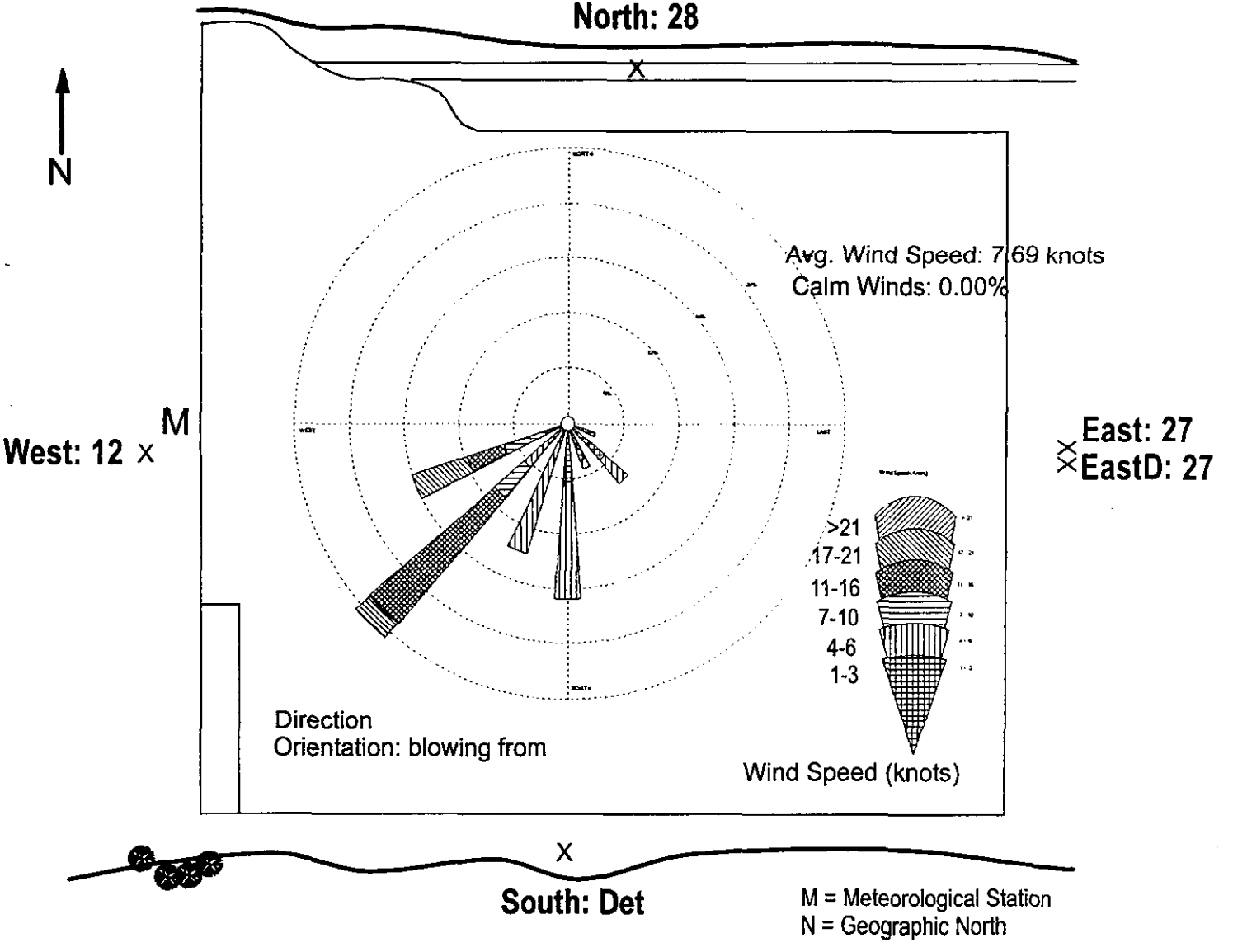


Figure 13
Atrazine Application Results (ng/m3)
Period 9



State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

APPENDICES

FOR THE

Report for the Application And Ambient Air Monitoring for Atrazine

Engineering and Certification Branch

Monitoring and Laboratory Division

Project No. C99-035 (Ambient)
C99-035a (Application)

Date: September 19, 2000

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

APPENDICES

FOR THE

Report for the Application And Ambient Air Monitoring for Atrazine

Engineering and Certification Branch

Monitoring and Laboratory Division

Project No. C99-035 (Ambient)
C99-035a (Application)

Date: August 31, 2000

APPENDIX I

SAMPLING PROTOCOL

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

Protocol for the Application and Ambient Air Monitoring of Atrazine In Sacramento County During Spring, 1999

Engineering and Laboratory Branch
Monitoring and Laboratory Division

Project No.
C99-035 Ambient
C99- 035a Application

Date: May 12, 1999

APPROVED:

Kevin Mongar, Project Engineer

Cynthia L. Castronovo, Manager
Testing Section

George Lew, Chief
Engineering and Laboratory Branch

This protocol has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Protocol for the Application and Ambient
Air Monitoring of Atrazine
In Sacramento County During Spring, 1999

I. Introduction

At the request (November 4, 1998 Memorandum, Okumura to Lew) of the California Department of Pesticide Regulation (DPR), the Air Resources Board (ARB) staff will determine airborne concentrations of the pesticide atrazine in Sacramento County over a six week ambient monitoring program and over a three day application monitoring program. This monitoring will be done to fulfill the requirements of AB 1807/3219 (Food and Agricultural Code, Division 7, Chapter 3, Article 1.5) which requires the ARB "to document the level of airborne emissions .... of pesticides which may be determined to pose a present or potential hazard..." when requested by the DPR. Monitoring is being conducted to coincide with the use of atrazine as a selective herbicide on corn and sudangrass.

The sampling and analysis for atrazine will follow the procedures and quality assurance guidelines described in the "Quality Assurance Plan for Pesticide Air Monitoring" (May 11, 1999 version)(Attachment I).

The draft method development results and "Standard Operating Procedures for the Analysis of Atrazine in Ambient Air" are included as Attachment II.

II. Chemical Properties of Atrazine

The following information on the physical/chemical properties of atrazine (6-chloro-N^2-ethyl-N^4-isopropopyl-1,3,5-triazine-2,4-diamine) was obtained from the November 24, 1998 memorandum "Use Information and Air Monitoring Recommendation for the Pesticide Active Ingredient Atrazine".

Pure atrazine (CAS:1912-24-9) exists as a colorless powder or white crystalline. Atrazine has a molecular formula of $C_8H_{14}N_5Cl$, and a molecular weight of 215.7 g/mole. It has a water solubility of 32.5 mg/L at 22 °C, a Henry's Constant of 1.45×10^{-9} atm·m^3/mol at 22 °C, and a vapor pressure of 1.68×10^{-7} mm Hg at 20 °C.

Atrazine is moderately to highly mobile in soils, especially in soils with low clay or organic matter content. Because atrazine does not absorb strongly to soil particles, and has a relatively long soil half-life, it is suspected to have a high potential for ground water contamination. De-adsorption from soil surfaces often occurs readily, and depends on temperature, moisture and PH. The loss of atrazine from soil by photodecomposition and/or volatilization depends on climate.

Photodegradation and volatilization may occur to some extent if high temperatures and prolonged sunlight follow application, but these factors are probably of little significance under typical field conditions. Chemical hydrolysis followed by microbial activity accounts for atrazine's decomposition in the soil.

The acute oral LD_{50} of atrazine for rats is 1869-3080 mg/kg (technical grade material). The LC_{50} (96 hour) for rainbow trout is 4.5-11.0 mg/L and 16 mg/L for bluegill sunfish.

III. Sampling

Samples will be collected by passing a measured volume of ambient air through XAD-2 resin. The sample tree is shown in Figure 1. The exposed XAD-2 resin tubes (SKC #226-30-06) are stored in an ice chest (on dry ice) or in a freezer until desorbed with 2.5 ml of ethyl acetate. The flow rate of 3 Lpm will be accurately measured and the sampling system operated continuously for 24 hours with the exact operating interval recorded in the log book. The resin tubes will be protected from direct sunlight and supported about 1.5 meters above the ground during application monitoring sampling periods and 1.5 meters above roof tops for the ambient monitoring. At the end of each sampling period, the tubes will be capped and placed in culture tubes with an identification label affixed. Subsequent to sampling, the sample tubes will be transported on dry ice, as soon as reasonably possible, to the ARB Monitoring and Laboratory Division laboratory for analysis. The samples will be stored in the freezer or extracted/analyzed immediately.

A rotameter is used to control and monitor sample flow rates. Samplers will be leak checked prior to and after each sampling period with the sampling cartridges installed. Any change in the flow rates will be recorded in the field log book. The field log book will also be used to record start and stop times, start and stop flow rates, sample identifications and any other significant data.

Ambient Monitoring

The use patterns for atrazine suggest that monitoring can occur in Sacramento County during the months of May and June. Four sampling sites will be selected in relatively high-population areas or in areas frequented by people. At each site, 24 discrete 24-hour samples will be taken during the sampling period. Background samples will be collected in an urban area distant to atrazine applications. Replicate (collocated) samples will be collected for six dates (each Wednesday) at each sampling location.

The sites will be selected by ARB personnel from the areas of Sacramento County where corn and sudangrass farming is predominant. Sites will be selected for their proximity to the fields with considerations for both accessibility and security of the sampling equipment. The sites are near areas of historical use of atrazine. ARB understands that DPR staff will verify and quantify

the actual use of atrazine that takes place during the study when the information becomes available.

The samples will be collected by ARB personnel over a six week period from (tentatively) May 17 - June 25, 1999. 24-hour samples will be taken Monday through Friday (4 samples/week) at a flow rate of 3 Lpm.

Application Monitoring

The use pattern for atrazine suggests that application-site monitoring should be conducted during the months of May or June in Sacramento County, and that the monitoring be associated with applications of atrazine to sudangrass at a rate of about 2.0 pounds per acre. Individual application monitoring schedules will vary based on the type and length of application but will follow the schedule guidelines outlined below in TABLE 2. Ideally, the monitoring study will include samples taken before, during and for approximately 72 hours following application.

TABLE 2. GUIDELINES FOR APPLICATION SAMPLING SCHEDULE

Sample period begins:	**Sample duration time**
Background (pre-application)	Minimum of 12 hours
During application	Length of application time
End of application	1 hour (or up to 1 hour before sunset) [1]
1 hour post-application	2 hours (or up to 1 hour before sunset) [1]
3 hour post-application	3 hours (or up to 1 hour before sunset) [1]
6 hour post-application	6 hours (or up to 1 hour before sunset) [1]
1 hour before sunset	Overnight[2] (until 1 hour after sunrise)
1 hour after sunrise	Daytime (until 1 hour before sunset)
1 hour before sunset	Overnight (until 1 hour after sunrise)
1 hour after sunrise	24-hour (until 1 hour after sunrise)

1 These sample duration times will be adjusted depending on length of application and time of sunset.

2 All overnight samples must include the period from one hour before sunset to one hour after sunrise. If the application extends beyond "1 hour before sunset" then the overnight sample will be started at the end of application.

Occasionally, a pesticide application may occur all day long and over the course of two or more days. In these instances samples are collected during the first daily application, followed by a sample from end of application to 1 hour before sunset, followed by an overnight sample ending at either the start of application or 1 hour after sunrise the next morning (same for second or more application days). Following the end of the application, samples are collected according to

the above schedule, starting with the 1-hour sample.

A minimum of four samplers will be positioned, one on each side of the field. A fifth sampler will be collocated at one position (downwind). Since atrazine is extensively used in the area, background (before application) samples should collect enough volume to achieve the recommended target 24-hour quantitation limit of 0.51 ug/m^3 (minimum of 12 hours at 3 liters/min). Ideally, samplers should be placed at a minimum of 20 meters from the field. If possible the samplers will be spaced equidistant from the edges of the field.

We will also provide in the monitoring report: 1) An accurate record of the positions of the monitoring equipment with respect to the field, including the exact distance that the sampler is positioned from the field, 2) an accurate drawing of the monitoring site showing the precise location of the meteorological equipment, trees, buildings, etc., 3) meteorological data collected at a minimum of 15 minute intervals including wind speed and direction, humidity, and comments regarding degree of cloud cover, 4) the elevation of each sampling station with respect to the field and 5) the orientation of the field with respect to North (identified as either true or magnetic north). Samples collected during fog episodes will be designated as such.

IV. Analysis

The method development results and "Standard Operating Procedures for the Sampling and Analysis of Atrazine in Ambient Air" (SOP) are included as Attachment II. The procedures consist of extraction of the XAD-2 with 2.5 mL of ethyl acetate followed by GC/MSD analysis. The sorbent is spiked with 188 ng of atrazine-$^{13}C_3$ prior to extraction for isotope dilution quantitation. The MSD is operated in selected ion monitoring mode. The method detection limit (MDL) and estimated quantitation limit (EQL) are approximately 3.47 ng per sample and 17.3 ng per sample respectively. The MDL calculation is: MDL=3.14(S) for n=7 replicate spikes, and the EQL is: EQL=5xMDL. The above MDL and EQL are estimates based on results presented in the attached SOP. The collection efficiency (recovery) of atrazine at a level of 125 ng/sample averaged 104%, after exposure of spiked cartridges to field conditions.

VI. Quality Assurance

Field Quality Control for the ambient monitoring will include:

1) Four field spikes (same environmental and experimental conditions as those occurring at the time of ambient sampling). The field spikes will be obtained by sampling ambient air at the background monitoring site for 24 hour periods at 3 Lpm (i.e., collocated with a background sample).

2) Four trip spikes prepared at the same level as the field spikes.

3) Four lab spikes prepared at the same level as the field and trip spikes.

4) Replicate samples will be taken for six dates at each sampling location.

5) A Trip blank will be obtained each week of sampling.

Field Quality Control for the application monitoring will include:

1) Four field spikes (same environmental and experimental conditions as those occurring at the time of ambient sampling). The field spikes will be obtained by sampling ambient air during background monitoring at the application site for the same duration as the background samples at 3 Lpm (i.e., collocated with background samples).

2) Four trip spikes prepared at the same level as the field spikes.

3) Four lab spikes prepared at the same level as the field and trip spikes.

4) Replicate samples will be taken for all samples at one of the sampling locations.

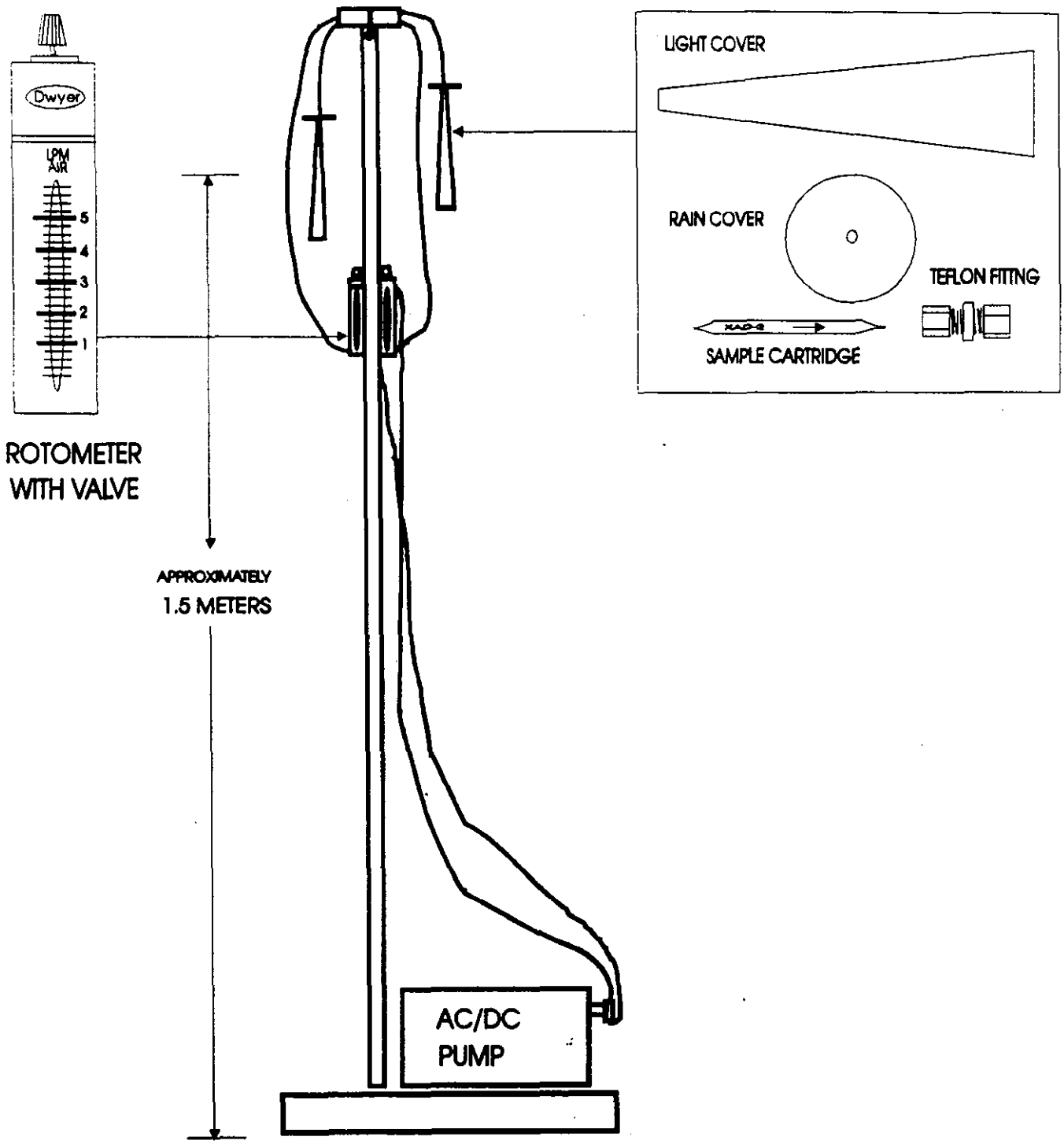
5) A Trip blank will be obtained.

The instrument dependent parameters (reproducibility, linearity and minimum detection limit) will be checked prior to analysis. A chain of custody sheet will accompany all samples. Flow controllers will be calibrated prior to and after sampling in the field.

VII. Personnel

ARB personnel will consist of Kevin Mongar (Project Engineer) and Instrument Technicians from the Testing Section of ARB.

FIGURE 1. SAMPLE TREE



ATTACHMENT I

Quality Assurance Plan for Pesticide Air Monitoring

State of California
California Environmental Protection Agency
Air Resources Board

QUALITY ASSURANCE PLAN FOR PESTICIDE AIR MONITORING

Prepared by the

Monitoring and Laboratory Division
Engineering and Laboratory Branch

Revised: May 11, 1999

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This Quality Assurance Plan has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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QUALITY ASSURANCE PLAN FOR PESTICIDE MONITORING

I. Introduction

At the request of the Department of Pesticide Regulation (DPR), the Air Resources Board (ARB) staff determines the airborne concentrations of specified pesticides following monitoring recommendations established by the DPR. This air monitoring is conducted to fulfill the requirements of AB 1807/3219 (Food and Agricultural Code, Division 7, Chapter 3, Article 1.5) which requires the ARB "to document the level of airborne emissions .... of pesticides which may be determined to pose a present or potential hazard..." when requested by the DPR. The documentation of airborne concentrations is usually accomplished through two types of monitoring. The first consists of five to eight weeks of **ambient** monitoring in the general area of, and during the season of, peak use of the specified pesticide. The second is monitoring around the perimeter of a field during and for 72 hours after an **application** has occurred. These are referred to as ambient and application monitoring, respectively. To help clarify the differences between these two monitoring programs, ambient and application are highlighted in bold in this document when the information applies specifically to either program. The purpose of this document is to specify quality assurance activities for the sampling and laboratory analysis of the monitored pesticide.

A. Quality Assurance Policy Statement

It is the policy of the ARB to provide DPR with accurate, relevant and timely air monitoring measurements of airborne pesticide concentrations. The goal of this document is to identify procedures that ensure the implementation of this policy.

B. Quality Assurance Objectives

Quality assurance objectives for pesticide monitoring are as follows.

(1) to establish the necessary quality control activities relating to site selection, method validation, analytical standard operating procedures (SOP), sample collection, sampling and analysis protocol, data reduction and final reports, and;
(2) to assess data quality in terms of precision, accuracy and completeness, and;
(3) to design air monitoring strategies to meet the pesticide target (estimated) quantitation levels as provided by the DPR.

II. Air Monitoring

All sampling will be coordinated through communication with the County Agricultural Commissioner's Office. The local Air Quality Management District (AQMD) or Air Pollution Control District (APCD) will be notified prior to any monitoring. Sample collection will be conducted by staff of the Testing Section or staff of the Air Quality Surveillance Branch of the ARB, or an approved ARB contractor.

A. Siting

The location and time-frame for **ambient** and **application** monitoring are based on direction provided by the DPR in their "Use Information and Air Monitoring Recommendation for Pesticide Active Ingredient" documents. These recommendations are based on historical trends (normally 2 to 3 years prior) and are submitted to the ARB by the DPR approximately 1 year in advance of intended monitoring. The recommendations direct ARB to monitor for a pesticide in specific counties during specific use periods. Pesticide use maps (historical) and histograms are used along with close coordination with staff of the County Agricultural Commissioner's Office to predict areas (and times) of use for the pesticide for the upcoming use year. Approximately one month prior to the scheduled monitoring DPR will reevaluate the historical use trends using the most recent pesticide use data available.

For selection of **ambient** monitoring sites, ARB staff work through authorized representatives of school districts, private companies or city, county or state government agencies. The probe (sampler) siting criteria for **ambient** pesticide monitoring were obtained from the U.S. EPA "Ambient Air Quality Surveillance" criteria (40 CFR, Part 58) and are listed in TABLE 1. As per the DPR monitoring recommendations, three to five sites are chosen. The monitoring objective in choosing these sites is to estimate population exposure in relatively high-population areas or in areas frequented by people (e.g., schools or school district offices, fire stations, or other public buildings). Sampling sites should be located near (in regions of) specific agricultural crops as recommended by the DPR. One additional site is chosen and designated to be an urban area "background" site which is located away from any expected applications. Information will be collected for each site and reported to DPR regarding; 1) the proximity of the each sampler to treated or potentially treated fields, including the distance and direction, and 2) the distance the sampler is located above the ground. Normally the **ambient** samplers will be located on the roof of a one-story building (e.g., at schools) with the sample cartridge located about 1.5 meters above the roof.

Probe siting criteria for placement of samplers around a pesticide **application** are the same as for **ambient** monitoring tests (TABLE I). A minimum of four samplers are positioned, one on each side of the field. A fifth sampler is collocated at one position, normally the downwind side (based on prevailing breezes). Once monitoring has begun, the sampling stations are not moved, even if the wind direction has changed. Ideally, samplers should be placed at a minimum distance of 20 meters from the perimeter of the field and should be equidistant from the field. *These requirements are nearly impossible to meet because of the physical limitations of most application sites. Twenty meters from a potential application field invariably places the sampler on another landowner's property, in another field where tractors and other equipment must operate, or into another orchard where the siting criteria cannot be met. Fences, canals, roads, ditches, railroad tracks, brush, trees, houses, barns, livestock, parked equipment, uncooperative neighbors, etc. are common obstacles. Monitors are placed as far as possible, up to 20 meters, from the field. Attempts are always made to center the samplers on the face of a side of the field. The sampler is placed to maximize the distance from the field and to avoid obstructions bordering the field. Conditions at the site will dictate the actual placement of monitoring stations.* Information is collected and reported to DPR regarding; 1) an accurate record of the positions of the monitoring equipment with respect to the field, including the exact distance that

the sampler is positioned from the field; 2) an accurate drawing of the monitoring site showing the precise location of the meteorological equipment, trees buildings and other obstacles; 3) the elevation of each sampling station with respect to the field and the orientation of the field with respect to North (identified as true or magnetic North). Determination of an appropriate site for an **application** test is based on the "recommendations" provided by the DPR. Parameters used to choose the site are:

1. crop type,
2. minimum field area of 10 acres,
3. minimum application rate (as directed by the DPR),
4. type of application (normally no preference by the DPR),
5. availability of sites on all four sides of the field which meet the criteria in Table 1 and can be sited 20 meters from the perimeter of the field (quite often this is not possible, i.e., normally 4 sites are chosen but they may not all meet the criteria), and
6. accessibility and security of the sampling sites/equipment.

Monitoring sites (fields) are arranged through communication with, and the voluntary cooperation of, applicators, growers or owners for **application** monitoring. Normally, representatives of the County Agricultural Commissioner's Office will make initial contact with the applicators/growers or will at least provide a list of possible candidates.

TABLE 1. PESTICIDE PROBE SITING CRITERIA SUMMARY

Height Above Ground (Meters)		2-15
Minimum Distance from Supporting Structure (Meters)	Vertical	1
	Horizontal	1
Other Spacing Criteria		1. Should be 20 meters from trees.
		2. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler.
		3. Must have unrestricted air flow 270° around sampler.
		4. Samplers at a collocated site (duplicate for quality assurance) should be 2-4 meters apart if samplers are high flow, >20 liters per minute.

B. Schedule

Samples for **ambient** pesticide monitoring will generally be collected over 24-hour periods on a schedule of 4 samples per week (Monday through Friday) for 5 to 7 weeks. Occasionally the normal schedule will be interrupted due to holidays and make-up samples may be collected over weekends.

Individual **application** monitoring schedules will vary based on the type and length of application but will follow the schedule guidelines outlined below in TABLE 2. Ideally, the

monitoring study will include samples taken before, during and for approximately 72 hours following application.

TABLE 2. GUIDELINES FOR APPLICATION SAMPLING SCHEDULE

Sample period begins:	Sample duration time
Background (pre-application)	Minimum of 12 hours
During application	Length of application time
End of application	1 hour (or up to 1 hour before sunset) [1]
1 hour post-application	2 hours (or up to 1 hour before sunset) [1]
3 hour post-application	3 hours (or up to 1 hour before sunset) [1]
6 hour post-application	6 hours (or up to 1 hour before sunset) [1]
1 hour before sunset	Overnight[2] (until 1 hour after sunrise)
1 hour after sunrise	Daytime (until 1 hour before sunset)
1 hour before sunset	Overnight (until 1 hour after sunrise)
1 hour after sunrise	24-hour (until 1 hour after sunrise)

1 These sample duration times will be adjusted depending on length of application and time of sunset.
2 All overnight samples must include the period from one hour before sunset to one hour after sunrise. If the application extends beyond "1 hour before sunset" then the overnight sample will be started at the end of application.

Occasionally, a pesticide application may occur all day long and over the course of two or more days. In these instances samples are collected during the first daily application, followed by a sample from end of application to 1 hour before sunset, followed by an overnight sample ending at either the start of application or 1 hour after sunrise the next morning (same for second or more application days). Following the end of the application, samples are collected according to the above schedule, starting with the 1-hour sample.

C. Meteorological Monitoring

Data on wind speed and direction, barometric pressure, relative humidity and air temperature will be collected during **application** monitoring by use of an on-site meteorological station. The meteorological data will be acquired using a data logger at a minimum of 15 minute intervals (averages). Meteorological systems will be calibrated as specified in the ARB manual, "Air Monitoring Quality Assurance, Volume II, Standard Operating Procedures for Air Quality Monitoring." Meteorological data are not collected for the **ambient** monitoring programs.

III. Method Validation

A. Method Detection Limit

The method detection limit (MDL) is defined as the lowest concentration at which individual measurement results for a specific analyte are statistically different from a blank (that may be zero) with a specified confidence level for a given method and matrix.

MDL is defined as 3.14 x s; where s is equal to the standard deviation of seven replicate spiked samples (e.g., XAD sample cartridges). The spiked samples are prepared and analyzed in the same way as actual samples. The spikes should be prepared at a concentration that is between one to five times the estimated MDL.

B. Estimated Quantitation Limit

The estimated quantitation limit (EQL) is the recommended lowest level for quantitative decisions based on individual measurements for a given method and representative matrix. This EQL is defined as 5 x MDL.

C. Reproducibility

The reproducibility of the method should be determined by performing five replicates at three different concentrations. The lowest level should be at or near the EQL. The average and standard deviation of each set of replicates should be determined and reported.

D. Extraction Efficiency

Extraction efficiency is defined as the amount of pesticide recovered from a spiked sample. Three replicates at two levels and blank should be extracted with the average and standard deviation determined for the replicates. The average amount divided by the amount added multiplied by 100 will give the percent recovery. Recommended recoveries should be between 70-130%.

E. Sampling Efficiency

Sampling efficiency is determined by spiking a sample with a known amount of pesticide. The spiked sample is placed in a sampler and set to the same flow rate and time that samples are collected. At a minimum three replicate spiked samples at a concentration two times the EQL of the method and a collocated background are collected. The samples are extracted and average recovery and standard deviation of the spike samples are determined.

F. Breakthrough

Breakthrough is determined by using a two stage sampling media (usually a filter or resin). The front stage is spiked with a known quantity of the pesticide. The breakthrough study samples are normally spiked at a relatively high level, e.g., at a level that might be observed

during an application study. If time and resources permit, both low and high level spike studies are run. The backup will be the same filter or resin type and placed in series with the front filter or resin. Air is passed through the sampler at the same flow rate and sample time as a real sample (minimum sample time of 24 hours). The front and backstage are recovered and extracted separately. If breakthrough is observed then the sampling strategy must be reviewed, modified and retested before the start of a sampling project.

G. Freezer Storage Stability

Spiked samples should be stored under the same conditions as the samples and for the anticipated time that the samples are stored. Recoveries are determined. A high (either at a level expected during the application study or at the high end of the calibration curve) and a low (1 to 2 times the EQL) concentration set should be studied. A set consists of three replicate spikes each for 3 time intervals.

IV. Field Sampling Quality Control Procedures

Monitoring programs will include the following quality control procedures:

A. Sample Labels

Sample labels will be affixed either directly to the sampling cartridge or will be placed in the individual sample container (e.g., culture tube or zip-lock bag). The sample labels will include at least the following information.

1. Pesticide name and the ARB project number.
2. Log number
3. Sample I.D.
4. Monitoring Location
5. Sampling end date
6. General comments

B. Log Sheets

Field data log sheets will be used to record the sampling log number, sample I.D., start and stop dates, start and stop times, start and end flow rate, initials of individuals conducting sampling, malfunctions, leak checks (at the beginning and end of each sampling period, see Appendix I), weather conditions (e.g., rain) and any other pertinent data which could influence sample results. Refer to Appendix I for a recommended log sheet format.

C. Chain of Custody Forms

Attached as Appendix II is a recommended format for chain of custody (COC) sheets. A COC sheet must accompany any/all samples during transport, transfer or storage. All exchanges of sample possession must be recorded. The laboratory will keep copies of the COCs and

forward the originals to the project engineer. The original COC sheets must be retained in the pesticide project file.

D. Flow Controller Calibration and Audit

Field flow controllers (rotameter, electronic flow controller or critical orifice) shall be calibrated against a referenced standard prior to a monitoring period. This referenced standard (e.g., digital bubble flowmeter or electronic digital mass flowmeter) must be verified, certified or calibrated with respect to a primary standard at least once per year by the Quality Management and Operations Support Branch (QMOSB) of ARB. Appendix V shows an example of a form to document the flow controller calibration results.

A flow audit of the field air samplers will be conducted by the QMOSB before each pesticide monitoring project. If results of this audit indicate a difference from the calibrated values of more than 10%, then the field flow controllers should be rechecked until they meet this objective. A written report of the QMOSB audit results will be included as an appendix in the final monitoring report.

Sampling flow rates should be checked in the field and noted before and after each sampling period. A separate, certified flow meter (i.e., not the one used in the sample train to control flow) will be used to check the flow. The flow rates should be checked after the initial sampling system leak check and before the "end" sampling system leak check.

E. Background Sampling

A background sample will be taken at all sites (4 sides) prior to an **application** test. The duration of the background sample should be sufficient to achieve the pesticide target 24-hour EQL, as directed by the DPR prior to the test, and must be a minimum of twelve hours and up to 24 hours if scheduling permits. This sample will establish if any of the pesticide being monitored is present in the air prior to the application. It also can indicate if other environmental factors are interfering with the detection of the pesticide of concern during analysis.

While one of the sampling sites for **ambient** monitoring is referred to as an "urban area background," it is not a background sample in the conventional sense because the intent is not to find a non-detectable level or a "background" level prior to a particular event (or application). This site is chosen to represent a low probability of finding the pesticide and a high probability of public exposure if significant levels of the pesticide are detected at this urban background site. Detectable levels of some pesticides may be found at an urban area background site if they are marketed for residential as well as commercial/agricultural use. An example of an urban area background site is the ARB air monitoring station in downtown Fresno.

F. Collocated Samples

For both ambient and application monitoring, the method precision will be demonstrated in part by collecting samples from collocated samplers (replicate analysis of samples also relates to method precision). An additional **ambient** sampler will be collocated at each of the sampling

sites. Normally, collocated samples will be collected at each **ambient** site every Wednesday for each week of sampling. The samplers should be located at least two meters apart if they are high volume samplers (>20 Lpm) in order to preclude airflow interference. This consideration is not necessary for low flow samplers. The collocated sampler for **application** monitoring should be positioned at the downwind sampling site where the highest concentrations are expected. The collocated site is not changed after the study starts.

G. Trip Blanks

A trip blank should be included with each batch of samples submitted for analysis. This will usually require one trip blank for an **application** monitoring study and one trip blank per week for an **ambient** monitoring program. Trip blanks are prepared by opening a sampling cartridge (e.g., breaking the ends of an XAD glass tube) in the field followed by normal labeling and sample transport (i.e., along with the samples).

H. Laboratory, Trip and Field Spikes

The *laboratory, trip and field* spikes are prepared, extracted and analyzed at the same time and they are generally all spiked at the same level. The *laboratory* spikes are immediately placed in the laboratory refrigerator (or freezer) and kept there until extraction and analysis. The *trip* spikes are kept in the freezer until transported to the field. The trip spike samples are kept on dry ice in an ice chest (the same one used for the samples) during transport to and from the field and at all times while in the field except for trip spike sample log-in and labeling. The *field* spikes are stored and transported in the same way as the trip spikes. However, field spikes are obtained by sampling ambient air through the spiked cartridge at the same environmental and experimental conditions as those occurring at the time of the study.

Ambient field spikes are collocated (same location, flow rate and sampling period) with a sample collected at the urban background sampling site (to minimize background concentrations). **Ambient** field spikes are normally prepared at a level of approximately 2 times the EQL, or at a level representative of ambient concentrations.

Application study field spikes are collocated with the background samples collected at the four sides of the application site (i.e., one background and one field spike per side). **Application** field spikes are normally prepared at a level close to expected air concentrations. Field spike results are corrected by subtracting the amount of pesticide residue found in the collocated, unspiked sample before calculation of residue recoveries.

I. Transportation of Samples

All samples will be capped, placed in a sample container (e.g., culture tube or zip-lock bag) and placed in an ice chest on dry ice immediately following sample collection and labeling. The samples will remain on dry ice until transferred to the laboratory and will then be stored in the lab refrigerator or freezer. Any special handling procedures will be identified during the method validation and will be outlined in the SOP.

J. Meteorological Station Calibration

Meteorological station calibration procedures will be performed as specified by the ARB manual, "Air Monitoring Quality Assurance, Volume II, Standard Operating Procedures for Air Quality Monitoring."

K. Preventive Measures

To prevent loss of data, spare pumps and other sampling materials should be kept available in the field by the operator. A periodic check of sampling pumps, meteorological instruments, extension cords, etc., should be made by sampling personnel.

V. Analysis

Method development and analysis of all field samples must be conducted by a fully competent laboratory. To ensure the capability of the laboratory, a systems audit may be performed, upon request, by the ARB Quality Management and Operations Support Branch (QMOSB) prior to the first analysis per a pesticide project. After a history of competence is demonstrated, an audit prior to each pesticide project is not necessary. However, during each pesticide project, the spiked samples discussed above should be provided to the laboratory to demonstrate accuracy and precision. These spiked samples will be prepared by qualified ARB laboratory staff.

If using GC/MS, isotope dilution is the recommended method for quantitation. Isotope dilution is where the isotope analog of the target compound is spiked to the sample prior to sample preparation. The internal standard goes through the same sample and analytical steps that the target analyte does thus compensating for losses during sample preparation and instrument variability during analysis. When no isotope is available an internal standard is recommended. An internal standard is spiked to the sample just prior to analysis. The internal standard compensates for instrument variability. If no suitable internal standard is found then an external standard method may be used.

VI. Analytical Quality Control Procedures

A. Mass Spectrometer Tuning (if MS is used)

A daily tune shall be performed using perfluorotributyl amine (PFTBA). The MS should be calibrated to optimize the MS for the mode of operation and type of pesticide analyzed. Documentation and performance criteria shall be specified in the standard operating procedure. A record of the tune for each batch should kept on file. A daily tune must be performed prior to the analysis of an analysis sequence and every 24 hours during an analysis sequence. If longer intervals between tunes are used, then the stability of the MS must be demonstrated during the method development phase and approved prior to the sample analysis.

B. Calibration

Initial Calibration

At the beginning of method development an initial multi-point calibration curve is performed to demonstrate the calibration range of the pesticide analyzed. A typical multi-point calibration consists of 5 different concentrations with a single replicate at each concentration. The calibration range usually should not exceed 40:1 with the lowest level standard at the EQL unless there is no need to measure values as low as the EQL. Depending on the linear range of the analyte, multi-points with other than 5 levels may be used although a multi-point with less than 3 levels is not permitted. Typically a linear calibration is preferred although a dynamic range using a quadratic is acceptable. For quadratic calibration curves quantitation can only be performed within the calibration range. Sample above the calibration curve must be diluted into the calibration range and reanalyzed.

Daily Calibration

Prior to the analysis of a set of samples a calibration must be performed. This calibration is called the daily calibration. The daily calibration is either a multi-point calibration or a mid-point calibration. The mid-point calibration consists of a single calibration at the mid-point of the initial multi-point calibration curve. If the mid-point is within a prescribed range (i.e., within +/- 20% of the original calibration) as determined from the initial calibration then the original initial calibration is still considered valid and the response is replaced. If the mid-point calibration is outside that range then another multi-point calibration must be performed. A calibration check at the same level is also run. If the mid-point calibration and the midpoint calibration check are within a prescribed range (i.e., +/-20%) of each other then analysis can begin. If the calibration check is outside the specified range then the problem must be rectified before analysis can begin.

C. Reagent Blanks.

A reagent (solvent) blank is performed at least for every batch of reagent used. The reagent blank uses the same solvent that was used for the sample preparation. The blank should be free of interferences. If low level contamination of the pesticide residue is found in the reagent blank (as may happen when using isotope dilution), then a reagent blank will be performed before analysis of each batch of samples. A reagent blank must be analyzed after any sample which results in possible carry-over contamination.

D. Laboratory Control Blank.

A laboratory blank is run with each batch of samples. A laboratory control blank (blank sampling media, e.g., resin cartridge or filter) is prepared and analyzed by the same procedures as used for field samples. Laboratory blank results must be no higher than 20% of the lowest value reported.

E. Laboratory Control Spike.

A laboratory control spike (LCS) is a resin cartridge spiked (at the level of the midpoint of the daily calibration runs) with a known amount of standard. The LCS is prepared and analyzed the same way as the samples. Two LCS are performed for each batch of samples. Laboratory control spikes need to be within 40% (100*difference/average) of each other and have recoveries that are +/-30% of the theoretical spiked value. If in the method development stage it is found that the differences or recoveries are larger, then they must be approved by ARB before the analysis can begin.

F. Calibration Check Samples.

A calibration check sample (CCS) is a mid-point standard run after every tenth sample in an analysis set. The purpose of the CCS is to ensure sample drift is within specified values. The CCS sample must be within +/- 25% of its theoretical value. If the standard is outside this range, then the samples associated with that calibration check sample must be reanalyzed. If in the method development stage it is found that the CCS variation is greater than 25%, then the percent variation limit used for the method must be approved by the ELB Branch Chief before the analysis can begin.

G. Duplicate Analysis.

A duplicate analysis is a sample analyzed in duplicate as a measure of analytical precision. Every tenth sample of an analysis set must be run in duplicate.

H. Standard Operating Procedures

Analytical methods must be documented in a Standard Operating Procedure (SOP) before monitoring begins. The recommended format for the SOP is provided in Appendix III. The SOP will include a discussion of all of the procedures outlined above in this section. The SOP will also include a summary of method development results as outlined in Section III above.

VII. Sampling and Analysis Protocol

Prior to conducting any pesticide monitoring, a sampling and analysis protocol, using this document as a guideline, will be written by the ARB staff. The protocol describes the overall monitoring program, the purpose of the monitoring and includes the following topics:

1. Identification of the sample site locations, if possible.

2. Description of the sampling train and a schematic showing the component parts and their relationship to one another in the assembled train, including specifics of the sampling media (e.g., resin type and volume, filter composition, pore size and diameter, catalog number, etc.).

3. Specification of sampling periods and flow rates.

4. Description of the analytical method (SOP included if possible).

5. Tentative test schedule and expected test personnel.

6. Safety information specific to the pesticide monitored.

Specific sampling methods and activities will also be described in the monitoring plan (protocol) for review by ARB and DPR. Procedures which apply to all sampling projects include: (1) sample log sheets (APPENDIX I), (2) chain of custody forms (APPENDIX II), (3) sunlight and rain shields for sample protection during monitoring, (4) sample storage in an ice chest on dry ice until delivery to the laboratory, (5) trip blanks and, (6) laboratory, trip and field spikes. The protocol should include: equipment specifications (when necessary), special sample handling and an outline of sampling procedures. The protocol should specify any procedures unique to a specific pesticide.

VIII. Final Reports and Data Reduction

The mass of pesticide found in each sample should be reported along with the volume of air sampled (from the field data sheet) to calculate the mass per volume for each sample. For each sampling date and site, concentrations should be reported in a table as ug/m^3 (microgram per cubic meter) or ng/m^3 (nanogram per cubic meter). When the pesticide exists in the vapor phase under ambient conditions, the concentration should also be reported as ppbv (parts per billion, by volume) or the appropriate volume-to-volume units at conditions of 1 atmosphere and 25 °C. Collocated samples should be reported separately as raw data, but then averaged and treated as a single sample for any data summaries. For samples where the end flow rate is different from that set at the start of the sampling period, the average of these two flow rates should be used to determine the total sample volume.

The final report should indicate the dates of sampling as well as the dates of laboratory receipt, extraction and analyses. These data can be compared with the stability studies to determine if degradation of the samples has occurred.

Final reports of all monitoring studies are sent to the Department of Pesticide Regulation, the Office of Environmental Health Hazard Assessment, the Department of Health Services, the Agricultural Commissioner's Office, the local AQMD as well as the applicator and/or the grower. Final reports are available to the public by contacting the ARB Engineering and Laboratory Branch.

A. Ambient Reports

The final report for ambient monitoring should include a map of the monitored area which shows nearby towns or communities and their relationship to the monitoring stations, along with a list of the monitoring locations (e.g., name and address of the business or public building)

including the locations Range/Township/ Section. A site description should be completed for any monitoring site which might have characteristics that could affect the monitoring results (e.g., obstructions). For ambient monitoring reports, information on terrain, obstructions and other physical properties which do not conform to the siting criteria or may influence the data should be described. Information will be collected for each site and reported to DPR regarding; 1) the proximity of the each sampler to treated or potentially treated fields, including the distance and direction, and 2) the distance the sampler is located above the ground.

Ambient data should be summarized for each monitoring location by maximum and second maximum concentration, average ("detected" results are factored in as (MDL+EQL)/2, <MDL results are factored in as MDL/2), total number of samples, number of samples above the estimated quantitation limit (EQL), number of samples "detected" and the number of samples below the MDL. For this purpose, collocated samples are averaged and treated as a single sample.

B. Application Reports

Similarly, a map or sketch indicating the general location (nearby towns, highways, etc.) of the field chosen for application monitoring should be included as well as a detailed drawing of the field itself and the relative positions of the monitors. For application monitoring reports, as much data as possible should be collected about the application conditions (e.g., formulation, application rate, acreage applied, length of application and method of application). This may be provided either through a copy of the Notice of Intent, the Pesticide Control Advisor's (PCA) recommendation or completion of the Application Site Checklist (APPENDIX IV). Meteorological data will be reported in 15 minute averages for the application site during the monitoring period. Meteorological and pesticide air concentration data will also be summarized as wind roses for each application sampling period. The raw meteorological data file will also be transferred to DPR on 1.44 mb floppy disk.

C. Quality Assurance

All quality control and quality assurance samples (blanks, spikes, collocated etc.) analyzed by the laboratory must be reported. Results of all method development and/or validation studies (if not contained in the S.O.P.) will also be reported. The results of any quality assurance activities conducted by an agency other than the analytical laboratory should be included in the report as an appendix. This includes analytical audits, system audits and flow rate audits.

APPENDIX I

SAMPLE FIELD LOG BOOK

SAMPLE FIELD LOG BOOK

Project: Pesticide Air Monitoring

Project #:

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial

APPENDIX II

CHAIN OF CUSTODY FORM

CHAIN OF CUSTODY FORM
CALIFORNIA AIR RESOURCES BOARD
MONITORING AND LABORATORY DIVISION
P.O. Box 2815, Sacramento CA 95812
PESTICIDE
CHAIN OF CUSTODY

SAMPLE RECORD

Job #: _____ Date: _____
Sample/Run #: _____ Time: _____
Job Name: _____
Sample Location: _____
Type of Sample: _____
Log #'s: _____

ACTION	DATE	TIME	INITIALS		METHOD OF STORAGE freezer, ice or dry ice
Sample Collected					
			GIVEN BY	TAKEN BY	
Transfer					
Transfer					
Transfer					
Transfer					
Transfer					
Transfer					

LOG #	ID #	

RETURN THIS FORM TO: _____

APPENDIX III

ANALYTICAL STANDARD OPERATING PROCEDURE FORMAT

ELEMENTS TO BE INCLUDED IN LABORATORY STANDARD OPERATING PROCEDURES FOR PESTICIDE AIR ANALYSIS

Engineering and Laboratory Branch
Air Resources Board
April 1999

I. SCOPE

A. Description of scope and detection limits of pesticide(s) to be analyzed.
B. Documents and references upon which method is based.
C. Definitions of any special terms must be given.

II. SUMMARY OF METHOD

A. General description of sampling and analytical procedure. Enough information should be included for an experienced analyst to readily recognize the principles of operation.

III. INTERFERENCES AND LIMITATIONS

A. Comments made here should cover both analytical and sampling problems, known and potential.

IV. EQUIPMENT AND CONDITIONS

A. INSTRUMENTATION: As specific a description as possible. Any modifications or improvements of the basic system must have an accompanying schematic. For chromatographic analysis list columns, flow rates, temperatures, detectors, amplifier ranges and attenuations, sample volumes, etc.
B. AUXILIARY APPARATUS: Provide a description of the function and operating conditions. Include a description of the sampling equipment if the equipment is specific to this method. For example, "Vacuum pump, ACME Model 62, capable of maintaining a 1 CFM Air Flow at 10" vacuum."

V. REAGENTS AND MATERIALS

A. Provide a list of all reagents used and specify purity and/or grade.
B. Describe preparation of any special reagents for analysis and sampling.
C. Specify composition, preparation, and concentrations of stock, intermediate, and working standards.
D. Describe in detail any necessary safety precautions for handling and disposition of chemicals.

VI. PROCEDURES

A. FIELD SAMPLING TECHNIQUES

1. Refer to appropriate Field Sampling S.O.P. for exact details of sampling, chain of custody and sample identification procedures.
2. Describe equipment used.
3. List sampling conditions: materials, flow rates, etc.
4. Describe any potential problems and limitations, with means of controlling such problems.
5. Describe any methods used to split samples for other types of analyses, if necessary.

B. LABORATORY SAMPLE PREPARATION/PRETREATMENT TECHNIQUES

1. Describe (or refer to an appropriate section of a Laboratory Quality Control Manual) a protocol for sample log-in procedures, including document control and sample examination for damage. Any possible hazards due to toxic or flammable chemicals must be clearly identified. Any sample storage requirements, such as immediate refrigeration or protection for light must be noted.
2. Describe any methods used for preconcentration, dilution clean-up filtration, extraction, concentration, etc., after the sample is received from the field.

C. ANAYSIS

1. Describe as clearly as possible the exact instrument configuration and set-up techniques
2. Describe analysis blank and calibration procedure with associated limits on precision and accuracy. Describe analysis of Control Samples and limits of the resulting data. Describe steps taken in an "out-of-control" situation. Specify the format and location of recorded calibration and Control Sample data.
3. Describe sample analysis. Description must include an example of expected data (for example, a sample chromatogram with all components of interest labeled).
4. Give calculation procedures for results. Describe data recording and data submittal.

VII. PERFORMANCE CRITERIA

A. Describe frequency of duplicate analyses, spikes, field blanks, and acceptable limits of each.
B. Describe frequency of multiple standard analyses to check method linearity and detection limit.
C. If confirmatory method is used, refer to specific S.O.P.

VIII. METHOD VALIDATION

Validation testing should provide an assessment of accuracy, precision, interferences, method recovery, method detection limit and estimated quantitation limit. Method documentation should include confirmation testing with another method when possible, and quality control activities necessary to routinely monitor data quality control such as use of control samples, control charts, use of surrogates to verify individual sample recovery, field blanks, lab blanks and duplicate analysis. All data should be properly recorded in a laboratory notebook.

The method should include the frequency of analysis for quality control samples. Analysis of quality control samples are recommended before each day of laboratory analysis and after every tenth sample. Control samples should be found to be within control limits previously established by the lab performing the analysis. If results are outside the control limits, the method should be reviewed, the instrument recalibrated and the control sample reanalyzed.

All quality control studies should be completed prior to sampling and include recovery data from at least three samples spiked at least two concentrations. Instrument variability should be assessed with three replicate injections of a single sample at each of the spiked concentrations. A stability study should be done with triplicate spiked samples being stored under actual conditions and analyzed at appropriate time internals. This study should be conducted for a minimum period of time equal to the anticipated storage period. Prior to each sampling study, a conversion/collection efficiency study should be conducted under field conditions (drawing ambient air through spiked sample media at actual flow rates for the recommended sampling time) with three replicates at two spiked concentrations and a blank. Breakthrough studies should also be conducted to determine the capacity of the adsorbent material if high levels of pesticide are expected or if the suitability of the adsorbent is uncertain. The following data will be included in the SOP.

A. A table describing linearity (correlation coefficients), accuracy (method bias), precision (standard deviations at all levels analyzed), and detection.
B. Data on sampling efficiencies, stability, pertinent breakdown products, break through volumes and desorption efficiencies.
C. Data on storage stability and conditions for samples and standards.
D. References to quality assurance information derived from published and/or interlaboratory sources if available.

APPENDIX IV

APPLICATION CHECKLIST

APPLICATION CHECKLIST

1. Pesticide:
2. County:
3. Crop:
4. Field Address:
5. Field Location (R/T/S):
6. Field Size (acres):
7. Contact Person:
8. Background Monitoring Period:
9. Target EQL Met?:
10. Product Applied:
11. Application Rate:
12. Comments on Tank Mix:
13. Method of Application (ground, air, irrigation, injection, tarping etc.):
14. Start of Application:
15. End of Application:
16. Pattern of Application: (e.g., east to west):
17. Weather Conditions:
18. Met Station Location (and elevation):
19. Any Other Applications in Area:
20. Sampler Elevations:

___ Camera pictures of each sampler from all 4 directions
___ Camcorder video of each sampler in relation to field and surroundings
___ Rotameter #s logged
___ Check dimensions of field with known acreage (43560 ft^2/acre) & compare sides
___ Crops around field labeled on diagram

APPENDIX V

FLOW CONTROLLER CALIBRATION FORM

FLOW CONTROLLER; 1-POINT FLOW CALIBRATION SHEET

Project: Pre: _____ Post: _____ Project #: _____ Date: _____

Desired Flow Rate: _____ Calib. by: _____ (name)

BUBBLEMETER READINGS

Controller ID:					
Controller Set:					
-Readings:					
-Readings:					
-Readings:					
Average:					
Deviation:					
Controller ID:					
Controller Set:					
-Readings:					
-Readings:					
-Readings:					
Average:					
Deviation:					

Average of Averages _____ : _____

PROCEDURE

1. Set-up sampler as if to collect sample, including filled sample cartridge.
2. Set flow controller to achieve desired flowrate and record controller setting.
3. Observe and record Bubblemeter flow (on form or direct to floppy - Change File name).
4. Reset to zero. Then repeat step 3 two more times.
5. Calculate the average of 3 readings.
6. Repeat steps 1 thru 5 for each Rotameter.
7. Average of Averages and Deviation automatically calculated. Replace any Rotameters that deviate by 10% or more from the Average of Averages.
8. QA Section will get a copy for comparison with their results for the same setups.

Attachment II

Standard Operating Procedures for the
Analysis of Atrazine in Ambient Air

State of California
Air Resources Board
Monitoring and Laboratory Division/ELB
Draft Standard Operating Procedure for the Sampling and Analysis
of Atrazine in Ambient Air
4/12/99 Version

Analyst: R. Okamoto
Reviewed by: R. Okamoto
Kevin Mongar

1. SCOPE

This is a sorbent tube, solvent extraction, gas chromatography/mass spectrometry method for the determination of atrazine from ambient air samples.

2. SUMMARY OF METHOD

The exposed XAD-2 resin tubes (SKC #226-30-06) are stored in an ice chest on dry ice or freezer until desorbed during sonication into 2.5 ml of ethyl acetate. The sorbent is spiked with 188 ng of atrazine-$^{13}C_3$ prior to extraction. The splitless injection volume is 1 ul. A gas chromatograph with a capillary column (95% methyl 5% phenyl silicone stationary phase) and a quadrapole mass spectrometer (MS) is used for analysis. The MS detector is operated in selected ion monitoring mode.

3. INTERFERENCES/LIMITATIONS

Method interferences may be caused by contaminants in solvents, reagents, glassware and other processing apparatus that can lead to discrete artifacts or elevated baselines. Co-eluting compounds trapped during sample collection may also interfere. A method blank must be done with each batch of samples to detect any possible method interferences.

4. EQUIPMENT AND CONDITIONS

A. INSTRUMENTATION:

Hewlett Packard 6890 chromatograph
Hewlett Packard 5973 mass selective detector
Hewlett Packard 7683 Autosampler

Detector: 280°C
Injector: 225°C
Injector Liner: Goose neck liner with glass wool
Column: HP HP-5MS or J&W DB-5MS, 30 meter, 0.25 mm i.d., 0.25 um film thickness.

Pre-column: Restek deactivated fused silica, 2 meter, 0.25 mm i.d.
GC Temp. Program: Initial 50°C, hold 3 min., to 300°C @ 15°C/min

Injector:

Pressure Initial 9.5 psi constant flow mode
Splitless: Purge on 2.0 min.
Carrier Gas: Helium
Column: Linear velocity: 38 cm/sec, electronic pressure control (9.5 psi @ 50 °C).

Auto Sampler:

Sample washes - 1, Sample pumps - 4, Sample Volume - 4 stops, Viscosity delay - 0 sec, Solvent A washes - 4, Solvent B washes - 4

Mass Spectrometer:

Electron Ionization
Selective Ion Monitoring; atrazine - 200 (quant. ion, 100%), 215 (qual. ion, 20%), 173 (qual. ion, 25%). atrazine-$^{13}C_3$ - 205 (quant. ion, 100%), 220 (qual. ion, 40%), Tuning: PFTBA

B. AUXILIARY APPARATUS:

1. Glass amber vials, 8 mL capacity.
2. Vial Shaker, SKC, or equiv.
3. Sonicator, Branson 2210
4. Autosampler vials with septum caps.

C. REAGENTS

1. Ethyl Acetate, Pesticide Grade or better
2. Acetone, Pesticide Grade or better
3. Atrazine 98% pure or better (e.g., from Chem Service).
4. Atrazine $^{13}C_3$ 99% pure or better (e.g., from Cambridge Isotope Laboratories)

5. ANALYSIS OF SAMPLES

1. A daily manual tune shall be performed using PFTBA. The instrument is tuned using masses - 69, 219, 502. The criterion for the tune are the peak widths at 1/2 the peak height, 0.50 $\pm$ .05, and the criteria for relative abundance; 69:100%; 219:100%-120%, and 502:7%-12%.

2. It is necessary to analyze a solvent blank with each batch of samples. The blank must be free of interferences. A solvent blank must be analyzed after any sample, which results in possible carry-over contamination.

3. A 5 point calibration curve shall be analyzed with each batch of samples.

4. With each batch of samples a laboratory blank and two laboratory control spike samples will be run with each batch of samples. A laboratory blank is a blank resin cartridge prepared and analyzed the same way the samples are analyzed. A laboratory control spike is a resin cartridge spiked with a known amount of standard. The control sample is prepared and analyzed the same way as the samples. Laboratory check samples need to be within 40% (100*difference/average) of each other and have recoveries that are +/-30% of the theoretical spiked value.

5. At least one calibration check sample must be analyzed for each set of 10 samples analyzed. The response of the standard must be within 20% of the initial calibration analyses for the batch. If the calibration check is outside the limit then those samples in the batch after the last calibration check that was within the 20% limit need to be reanalyzed.

6. Carefully score the secondary section end of the sampled XAD-2 tube above the glasswool and break at the score. Remove the glass wool plug from the secondary end of the XAD-2 tube with forceps and place it into a 4 mL amber colored sample vial. Pour the backup portion of the XAD-2 into the same vial. Spike the back end of the primary XAD with 12.5 ul of 20 ng/ml atrazine -$^{13}C_3$. Let the solvent evaporate for approximately 10 minutes. Remove the middle glass wool plug and store in the 4 mls amber vial. Retain the secondary section of the XAD-2 tube for later analysis if needed to check the possibility of breakthrough.

7. Pour the primary XAD into a 8 ml vial. Remove the glasswool plug from the tube and put into the 8 ml vial. Rinse the tube with 2.5 mls of a 50:50 (vol) solution of ethyl acetate and acetone and pour the rinse into the 8 ml vial.

8. Place the sample vial on a desorption shaker (or ultra sonic water-bath) for 30 minutes. Remove vial and store at -20°C until analysis. Prior to analysis transfer an aliquot to a GC autosample vial.

9. After calibration of the GC system, inject 1.0 ul of the extract. If the resultant peak for atrazine has a measured concentration greater than that of the highest standard injected, dilute the sample and re-inject.

10. Calculate the concentration in ng/mL based on the data system calibration response factors. If the sample has been diluted, multiply the calculated concentration by the dilution factor.

11. The atmospheric concentration is calculated according to:

Conc., ng/m^3 = (Extract Conc., ng/mL X 2.5 mL) /Air Volume Sampled, m^3

6. QUALITY ASSURANCE

A. INSTRUMENT REPRODUCIBILITY

Five injections of 4 ul each were made of atrazine standards at three concentrations in order to establish the reproducibility of this instrument. This data (Testing Section lab, 12/12/98) is shown in Table 1.

TABLE 1. Instrument Reproducibility

Atrazine-$^{13}C_3$ Amt. (ng/ml)	Atrazine-$^{13}C_3$ Response	Atrazine Amt. (ng/ml)	Atrazine Response	Amt. Ratio	Resp Ratio	Response Ratio RSD
75	599	25	489	.125	.816	
75	565	25	460	.125	.814	
75	564	25	450	.125	.798	
75	554	25	471	.125	.850	
75	588	25	465	.125	.791	2.82
75	659	100	2449	1.33	3.72	
75	682	100	2626	1.33	3.85	
75	635	100	2605	1.33	4.10	
75	619	100	2574	1.33	4.16	
75	707	100	2760	1.33	3.90	4.62
75	774	400	12833	5.33	16.3	
75	777	400	13123	5.33	16.6	
75	788	400	12570	5.33	16.9	
75	769	400	12407	5.33	16.0	
75	851	400	14239	5.33	16.7	2.21

B. CALIBRATION

Linearity

A linear regression was performed on a 25 pg/ul-400pg/ul 5-point calibration curve made on 3/04/99.

Resp Ratio = (3.21)*Amt - .326

R^2 = 1.000

Calibration Check

A calibration check sample is run after every tenth sample in a batch to verify the system is still in calibration. Calibration check samples must be within 20% of the assigned value. If the check sample is outside that range then the ten samples within that sample batch will be rerun.

C. MINIMUM DETECTION LIMIT

Detection Limit is based on USEPA MDL calculation. Using the analysis of seven replicates of a low level matrix spikes, the method detection limit (MDL), and the estimated quantitation limit (EQL) for atrazine were calculated by:

MDL = 3.14*s

EQL = 5*MDL

where:

s = the standard deviation of the concentration calculated for the seven replicate spikes.

Given s = 0.46 for the seven samples, the MDL and EQL are calculated as follows.

MDL = 3.14 *.441 = 1 (1.39) pg/ul
EQL= 5 *1.39 = 6.93 pg/ul

Based on the 2.5 mL extraction volume and assuming a sample volume of 4.32 m^3 (3 lpm for 24 hours) the EQL for ambient concentration of atrazine is:

(6.93 ng/mL)(2.5 mL) / (4.32 m^3) = 4.01 ng/m^3 per 24-hour sample

If the internal standard atrazine-$^{13}C_3$ is spiked in the sample at a high level, then the atrazine impurity in the atrazine-$^{13}C_3$ internal standard can be higher than the detection limit of the method. For example 140 pg/ul of 99% pure atrazine-$^{13}C_3$ contains 1.4 pg/ul of atrazine which is the same level as the method detection limit. To distinguish the atrazine background level from atrazine in the sample the following procedure is followed. Seven replicate blank samples with only the internal standard are analyzed. The average blank level is determined and added to three times the standard deviation of the replicate blanks (BKG+3s). Sample values between the MDL and BKG + 3s cannot be distinguished from atrazine impurity of the internal standard. Values above BKG+3s are considered real and are not attributed to the blank.

Results are reported to 3 significant figures above the EQL. Results below EQL but greater than or equal to BKG +3s are reported as detected (det). Results below BKG +3s but greater than or equal to MDL are reported as BKG. Results less than MDL are reported as <MDL.

D. COLLECTION AND EXTRACTION EFFICIENCY (RECOVERY)

125 ng of atrazine standard was spiked on the primary section of each of three XAD-2 sampling tubes and 1000 ngs of atrazine standard was spiked on the primary section of each of three XAD-2 tubes. The spiked tubes were then subjected to an airflow of 3 lpm for 24 hours. The samplers were set-up at 600 Market blvd. (Sacramento) at an ambient temperature (temperature not recorded). The primary sections were extracted with a 50:50 mixture of ethyl acetate and acetone and the extracts were stored in the freezer until analyzed. The average percent recoveries of atrazine from primary sections of three tubes spiked with 125 ngs of atrazine was 104% with a relative standard deviation of 7.57% and the average percent recoveries of three tubes spiked with 1000 ngs of atrazine was 90.4%, with an relative standard deviation of 10.4%.

E. STORAGE STABILITY

Storage stability studies were conducted over an 8 week period. The primary sections of 12 tubes were spiked with 125 ng of atrazine. The spiked tubes were stored in the freezer at -20°C and extracted/analyzed on storage weeks 0, 2, 4 and 8. The storage recoveries (average results) were 112%, 101%, 119%, and **(in progress)** for weeks 0, 2, 4, and 8 respectively.

A second set of tubes were spiked with 1000 ngs of atrazine. The spiked tubes were stored in the freezer at -20°C and extracted/analyzed on storage weeks 2, 4 and 8. Three tubes each were analyzed on week 0, 2, 4, and 8. The storage recoveries (average results) were 102%, 84.8%, 119% and **(in progress)** for weeks 2, 4, and 8 respectively.

F. BREAKTHROUGH

The primary sections of three tubes were spiked with 5000 ngs atrazine/tube then run for 24 hours at 3 lpm (see Section D above). No atrazine was detected in the back-up resin bed of any of the tubes.

G. SAFETY

atrazine is slightly to moderately toxic to humans and other animals. The oral LD_{50} range is 672 to 3000 mg/kg in rats and 850 to 1750 mg/kg in mice. The 4-hour inhalation LC50 in rates is 5200 mg/m^3. OSHA and NIOSH time weighted average is 5 mg/m^3.

APPENDIX II

LABORATORY REPORT

California Environmental Protection Agency

Air Resources Board

Final Atrazine Method Development and Atrazine Analytical Results for Ambient Monitoring and Application Samples

Special Analysis Section
Northern Laboratory Branch
Monitoring and Laboratory Division

Prepared by
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APPROVAL DATE: September 19, 2000

Project Numbers: C99-035 and C99-035A

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Atrazine Method Development and Atrazine Analytical Results for Ambient Monitoring and Application Samples.

1.0 INTRODUCTION

The Department of Pesticide Regulation (DPR) requested the Air Resources Board (ARB) to develop an air sampling and analysis method and conduct ambient air and application site monitoring for atrazine. This report presents the laboratory results and includes the atrazine standard operating procedures and method validation data. The results have been reviewed by the staff and are believed to be accurate within the limits of the method.The method estimated quantitation limit (EQL) is 22.0 ng/sample. ARB staff collected and analyzed ambient air and application site samples. This report covers method development, analytical results, and quality assurance results. The final atrazine SOP is attached as Appendix 1.

2.0 METHOD DEVELOPMENT AND STANDARD OPERATING PROCEDURE.

2.1 Overview

The method uses XAD2 sorbant tubes for sample collection. Collected samples are extracted by sonication using 3 ml solution of ethyl acetate and acetone (50:50). Analysis is performed using high-resolution gas chromatography/mass spectrometry in the selective ion-monitoring mode to maximize sensitivity. The analysis uses atrazine-$^{13}C_3$ as an internal standard to compensate for sample preparation and analytical variability.

2.2 Instrument Reproducibility

Five injections of 4 µl each were made of atrazine standards at three concentrations in order to establish the reproducibility of this instrument (Table 1.)

2.3 Calibration

The instrument was initially calibrated using 25 -- 400ng/ml standards to produce a 5-point calibration curve with an $r^2 = 1.000$. The production run used 25 -- 800 ng/ml standards for the 5-point linear run before each analytical sample batch.

2.4. Minimum Detection Limit (MDL)

The method follows standard United States Environmental Protection Agency (USEPA) procedures to calculate the MDL. Using the analysis of seven low level matrix spikes (12.5ng/ml), the method detection limit (MDL), and EQL for atrazine were calculated by:

s = the standard deviation of the concentration calculated for the seven replicate spikes. For atrazine s = 1.404 ng/sample (based on 3 ml extract).

MDL = (3.14)(s) = (3.14) *(1.404)= 4.41 ng/sample.*

EQL = (5)(MDL) = (5) *(4.41ng/sample) = 22.0 ng/sample*

Results above the EQL are reported to three (3) significant figures. Results below the EQL but greater than or equal to the MDL are reported as detected (DET). Results less than MDL are reported as <MDL.

2.5. *Collection And Extraction Efficiency (Recovery)*

Six (6) XAD-2 sample tubes were used to demonstrate method recovery. The primary section of three (3) sample tubes were spiked with 125 ng of atrazine standard and three (3) others with 1000 ng. The spiked tubes were then subjected to an airflow of three (3) lpm for 24 hours at ambient temperature (temperature not recorded). A 50:50 mixture of ethyl acetate and acetone was used to extract the primary section of the spiked tubes. The extracts were stored in the freezer until analyzed. The results are presented below.

Primary Section Atrazine Spike	Mean Percent Recovery	RSD
125 ng	104%	7.57%
1000 ng	90.4%	10.4%

2.6. *Storage Stability*

Staff spiked the primary sections of six (6) tubes with atrazine at 125 ng and six (6) tubes at 1000ng. The spiked tubes were stored in the freezer at -20^{0}C and extracted/analyzed on storage weeks 0, 2, 4 and 8. The storage recoveries (average results) and shown below.

8 week Storage Stability Study (Percent storage recoveries)		
Week	125 ng of atrazine	1000 ng of atrazine
0	112%	102%
2	101%	84.8%
4	119%	119%
8	104%	105%

2.7. *Breakthrough*

The primary sections of three tubes were spiked with 5000 ng/tube then run for 24 hours at three (3) lpm. Analysis of the back-up resin bed did not detect atrazine in any of the tubes.

3.0 AMBIENT AIR MONITORING SAMPLE RESULTS.

Extraction and analysis of all samples was complete within 15 days of receipt. Sample ARB 21 was lost after sample preparation.

Staff flagged samples ARB-3D, MRE-3D, GAL3D, and TER3D (See section 4.4 for details and discussion). The laboratory received a total of 152 ambient and QA samples for analysis from 5/24/99 to 7/14/99, as well as six trip blanks, four trip spikes, four field spikes and four laboratory spikes.

Tables 2 presents the results of the analysis of the atrazine ambient samples. An asterisk to the right of the atrazine amount denotes the results are the average of duplicate analysis.

4.0 ATRAZINE AMBIENT ANALYTICAL QUALITY CONTROL

4.1 Laboratory solvent blanks

A laboratory solvent blank (LSB) is analyzed with each of the seven (7) ambient atrazine analytical sample batches, prior to the calibration samples and laboratory control samples. Staff defines a batch as the samples in an automated GC/MS analysis sequence. Table 3 provides the results of the laboratory solvent blanks for the seven analytical sample batches. Analysis of blanks B9052707, B9062207, B9062307, and B9071407 indicated the presence of atrazine (DET). A review of the trip blanks and laboratory control blanks (LCB) run with each batch of samples showed no detectable amounts of atrazine. From this information it was determined that these LSB samples were possibly contaminated. However this should not affect any of the sample results since the LCB's showed no contamination. All other blanks were less than the MDL of 4.41 ng/sample.

Note: Throughout the study, the LSB aliquots were obtained from a vial that was filled with solvent at the beginning of the study (i.e., the vial was not refilled for the duration of the study). The vial was likely contaminated at a level near the MDL. Since the problem was not detected until the second round of QA which was performed 3 months after all the samples for atrazine, bifenthrin, propargite, and cycloate were analyzed. In hindsight, it should have been detected upon the initial QA review but unfortunately, it was not.

4.2 Laboratory control spikes

Two laboratory control spikes (LCS) were run before the analysis of each set of samples. Staff defines a sample set as all the samples that were prepared during the same period. A LCS is a resin cartridge spiked with 300 ng of atrazine. The control sample is prepared and analyzed as described for the samples. LCS recoveries ranged from 87.4%-116% and the relative difference between samples in each pair ranged from 1.41% - 19.4%. See table 4.

4.3 Laboratory control blanks

A single laboratory control blank (LCB) is run with each sample set. The LCB sample cartridge is prepared and analyzed as described for the ambient samples. The LCB results are presented in Table 5. No atrazine was detected above the MDL.

4.4 Calibration check samples

Staff ran a calibration check sample (CCS) after every tenth sample in a analysis batch. CCS results are given in Table 6. The average CCS percent recovery was 100% of the expected atrazine amount with a relative standard deviation of 2.94%. The 05/28/99 sample batch did not include a CCS for samples ARB-3D, HER-3D, MRE-3D, GAL-3D, and TER3D. Although the variability for all other CCS is well below 20%, without the CCS this cannot be verified and these five samples are flagged.

4.5 Duplicate analysis

Duplicate analysis is performed on every tenth sample (see Table 7). The relative difference for duplicate pairs is calculated if the value is equal to or higher than the EQL. No duplicate pair was above the EQL.

5.0 FIELD, TRIP, AND LABORATORY SPIKES AND TRIP BLANKS

Four (4) laboratory spikes, four (4) trip spikes and four (4) field spikes were analyzed for the ambient atrazine test.

5.1 Laboratory spikes

Four (4) tubes were spiked with 300 ng of atrazine on 5/28/99 and stored in the freezer until they were analyzed on 6/8/99. The laboratory spike results are Table 8. The average percent recovery was 93.4% and the relative standard deviation was 3.18%.

5.2 Trip spikes

Staff spiked four (4) tubes (trip spikes) with 300 ng of atrazine. The trip spike results are in Table 9. The average recovery was 92.0% and the relative standard deviation was 9.38%.

5.3 Field spikes

Staff spiked (300 ng) six (6) tubes as field spikes on 5/28/99. These were placed on a sampler at the sampling site along with a collocated sample (unspiked). Sampling of both occurred concurrently. The field spike results are in Table 10. The average recovery of the field spikes was 91.9% with a relative standard deviation of 4.21%.

5.4 Trip blanks

Six (6) trip blanks were collected, one for each week of ambient monitoring (Table 11).

6.0 APPLICATION SAMPLE RESULTS.

6.1 Application Samples

Staff collected forty-nine (49) application samples along with four (4) field spikes, four (4) trip spikes, four laboratory spikes, and one (1) trip blank. Analysis was complete within four days of sample receipt. Table 12 presents the results of the analysis of the atrazine application samples.

7.0 ATRAZINE APPLICATION ANALYTICAL QUALITY CONTROL

Two laboratory control spikes and a laboratory control blank were prepared with each batch of samples. Before beginning analysis of a batch, staff ran a laboratory solvent blank and a multi-point calibration. Staff ran calibration check samples and duplicates for each sample batch. Additional QC included field spikes, trip spikes, laboratory spikes, and trip blanks.

7.1 Laboratory solvent blanks

Staff ran a laboratory solvent blank before the analysis of an analytical sample batch. There were a total of two (2) analytical application batches. Table 13 provides the results of the laboratory solvent blanks for the two (2) sample batches. Background levels of atrazine detected in both laboratory solvent blanks were probably due to contamination. Atrazine was not present or detected in the trip or laboratory control blanks. See section 4.1.

7.2 Laboratory control spikes

Each sample set included two (2) laboratory control spikes (LCS) at 300 ng. The LCS is prepared and analyzed the same way as the samples. LCS recoveries ranged from 94.1%-100% and the relative difference between samples in the set was 6.54%. See Table 14.

7.3 Laboratory control blanks

A single laboratory control blank (LCB) is run with the analysis of each sample set. The LCB blank sample cartridge is prepared and analyzed in the same manner as the samples. See Table 15.

7.4 Calibration check samples

Each analytical batch included calibration check samples (CCS). A CCS is run after every

tenth sample in a sample batch. This allows staff to ensure the instrument drift does not exceed 20%. The average CCS percent recovery was 102% of the expected atrazine amount with a relative standard deviation of 3.92%. See Table 16.

7.5 Duplicate analysis

Analysis of a sample batch included a duplicate on every tenth (10) sample. Relative difference was calculated on duplicate pairs when the values were at or higher than the EQL. The percent difference ranged from0.180% to 30.4 % with all but one duplicate pair less than 5% difference. See Table 17.

8.0 APPLICATION FIELD, TRIP, AND LABORATORY SPIKES AND TRIP BLANKS

Four (4) laboratory spikes, four (4) trip spikes and four (4) field spikes were analyzed for the atrazine application test.

8.1 Laboratory spikes

Four (4) laboratory spikes were spiked with 300 ng on 5/28/99 and stored in the freezer at 0^0C until they were analyzed on 6/17/99. The average percent recovery was 91.7% and the relative standard deviation was 6.78%. See Table 18.

8.2 Trip spikes

Staff spiked four (4) samples as "trip spikes" with 300 ng of atrazine on 5/28/99. Trip spikes accompanied samples to the sampling site. These trip spikes returned to the laboratory along with the samples. Analysis of the trip spikes occurred on 6/16/99. The average recovery was 97.0% and the relative standard deviation was 6.18%. See Table 19.

8.3 Field spikes

Staff prepared a series of four (4) field spikes at 300 ng of atrazine on 05/28/99. At the sampling site, the spikes are treated in the same manner as a standard sample. A collocated sample ran concurrently with each field spike. The average recovery of the field spikes was 94.9% with a relative standard deviation of 8.37%. See Table 20.

8.4 Trip blanks

One (1) application trip blank, TB, was analyzed. Atrazine was less than the MDL of 6.9 ng/sample.

8.5 Backup resin analysis.

Staff evaluated the backup resin beds of four ambient samples with the highest ambient atrazine levels for breakthrough. No atrazine was above background in any of the backup

resin beds. See Table 21.

TABLE 1: Instrument Reproducibility

Atrazine-$^{13}C_3$ Amt. (ng/ml)	Atrazine-$^{13}C_3$ Response	Atrazine Amt. (ng/ml)	Atrazine Response	Amt. Ratio	Resp Ratio	Response Ratio RSD
75	599	25	489	0.333	0.816	
75	565	25	460	0.333	0.814	
75	564	25	450	0.333	0.798	
75	554	25	471	0.333	0.850	
75	588	25	465	0.333	0.791	2.82
75	659	100	2449	1.33	3.72	
75	682	100	2626	1.33	3.85	
75	635	100	2605	1.33	4.10	
75	619	100	2574	1.33	4.16	
75	707	100	2760	1.33	3.90	4.62
75	774	400	12833	5.33	16.3	
75	777	400	13123	5.33	16.6	
75	788	400	12570	5.33	16.9	
75	769	400	12407	5.33	16.0	
75	851	400	14239	5.33	16.7	2.21

Note: Response Ratio = (3.21)(Amt Ratio) - 0.326*

Table 2. Ambient Air Monitoring Results

Log #	Date Received	Sample Name	Analysis Date	Sample Amount (ng/sample)
	06/07/99	ASS0528-1	06/08/99	2.83E+2
	06/07/99	ASS0528-2	06/08/99	2.84E+2
	06/07/99	ASS0528-3	06/08/99	2.86E+2
	06/07/99	ASS0528-4	06/08/99	2.67E+2
1	05/24/99	ARB-1	05/28/99	<MDL
2	05/24/99	HER-1	05/28/99	<MDL
3	05/24/99	MRE-1	05/28/99	Det
4	05/24/99	GAL-1	05/28/99	<MDL
5	05/24/99	TER-1	05/28/99	<MDL
6	05/24/99	ARB-2	05/28/99	<MDL
7	05/24/99	HER-2	05/28/99	<MDL
8	05/24/99	MRE-2	05/28/99	<MDL
9	05/24/99	GAL-2	05/28/99	<MDL
10	05/24/99	TER-2	05/28/99	<MDL
11	05/24/99	ARB-3	05/28/99	<MDL
12	05/24/99	ARB-3D	05/29/99	<MDL
13	05/24/99	HER-3	05/28/99	Det
14	05/24/99	HER-3D	05/29/99	<MDL
15	05/24/99	MRE-3	05/28/99	Det
16	05/24/99	MRE-3D	05/29/99	Det
17	05/24/99	GAL-3	05/28/99	<MDL
18	05/24/99	GAL-3D	05/29/99	<MDL
19	05/24/99	TER-3	05/28/99	<MDL*
20	05/24/99	TER-3D	05/29/99	<MDL
21	05/24/99	ARB-4	05/29/99	<MDL
22	05/24/99	HER-4	05/29/99	Det
23	05/24/99	MRE-4	06/03/99	Det
24	05/24/99	GAL-4	06/03/99	Det
25	05/24/99	TER-4	06/03/99	<MDL
26	06/01/99	ARB-5	06/02/99	<MDL
27	06/01/99	HER-5	06/02/99	Det
28	06/01/99	MRE-5	06/02/99	<MDL
29	06/01/99	GAL-5	06/02/99	Det
30	06/01/99	TER-5	06/02/99	<MDL
31	06/01/99	ARB-6	06/02/99	<MDL
32	06/01/99	HER-6	06/03/99	Det
33	06/01/99	MRE-6	06/03/99	<MDL
34	06/01/99	GAL-6	06/03/99	Det
35	06/01/99	TER-6	06/03/99	<MDL*
36	06/01/99	ARB-7	06/03/99	<MDL
37	06/01/99	ARB-7D	06/03/99	<MDL
38	05/24/99	TB990526	06/03/99	<MDL
39	06/01/99	HER-7	06/03/99	Det
40	06/01/99	HER-7D	06/03/99	Det
41	06/01/99	MRE-7	06/03/99	<MDL
42	06/01/99	MRE-7D	06/03/99	<MDL
43	06/01/99	GAL-7	06/03/99	Det
44	06/01/99	GAL-7D	06/03/99	Det
45	06/01/99	TER-7	06/03/99	<MDL
46	06/01/99	TER-7D	06/03/99	<MDL*

Log #	Date Received	Sample Name	Analysis Date	Sample Amount (ng/sample)
47	06/01/99	ARB-8	06/03/99	<MDL
48	06/01/99	HER-8	06/03/99	Det
49	06/01/99	MRE-8	06/03/99	Det
50	06/01/99	GAL-8	06/03/99	<MDL
51	06/01/99	TER-8	06/03/99	<MDL
52	06/07/99	ARB-9	06/09/99	<MDL
53	06/07/99	TB99601	06/09/99	<MDL
54	06/07/99	AFS0528-1	06/09/99	2.84E+2
55	06/07/99	AFS0528-2	06/09/99	2.74E+2
56	06/07/99	AFS0528-3	06/09/99	2.63E+2
57	06/07/99	AFS0528-4	06/09/99	2.85E+2
58	06/07/99	HER-9	06/09/99	<MDL
59	06/07/99	MRE-9	06/09/99	<MDL
60	06/07/99	GAL-9	06/09/99	<MDL
61	06/07/99	TER-9	06/09/99	<MDL*
62	06/07/99	ARB-10	06/09/99	<MDL
63	06/07/99	HER-10	06/09/99	Det
64	06/07/99	MRE-10	06/09/99	Det
65	06/07/99	GAL-10	06/09/99	<MDL
66	06/07/99	TER-10	06/09/99	<MDL
67	06/07/99	ARB-11	06/09/99	<MDL
68	06/07/99	ARB-11D	06/09/99	<MDL
69	06/07/99	FS-1	06/09/99	2.63E+2
70	06/07/99	FS-2	06/09/99	2.85E+2
71	06/07/99	HER-11	06/09/99	Det*
72	06/07/99	HER-11D	06/09/99	Det
73	06/07/99	MRE-11	06/09/99	<MDL

Log #	Date Received	Sample Name	Analysis Date	Sample Amount (ng/sample)
74	06/07/99	MRE-11D	06/09/99	<MDL
75	06/07/99	GAL-11	06/09/99	<MDL
76	06/07/99	GAL-11D	06/09/99	<MDL
77	06/07/99	TER-11	06/09/99	<MDL
78	06/07/99	TER-11D	06/09/99	<MDL
79	06/07/99	TS-1	06/08/99	2.89E+2
80	06/07/99	TS-2	06/08/99	3.07E+2
81	06/07/99	TS-3	06/08/99	3.24E+2
82	06/07/99	TS-4	06/08/99	2.88E+2
83	06/15/99	ARB-12	06/22/99	<MDL
84	06/15/99	HER-12	06/22/99	Det
85	06/15/99	MRE-12	06/22/99	<MDL
86	06/15/99	GAL-12	06/22/99	<MDL
87	06/15/99	TER-12	06/22/99	<MDL
88	06/15/99	TB99615	06/23/99	<MDL
89	06/15/99	ARB-13	06/22/99	<MDL
90	06/15/99	HER-13	06/22/99	Det
91	06/15/99	MRE-13	06/22/99	Det
92	06/15/99	GAL-13	06/22/99	<MDL
93	06/15/99	TER-13	06/22/99	<MDL*
94	06/15/99	ARB-14	06/22/99	<MDL
95	06/15/99	ARB-14D	06/23/99	<MDL
96	06/15/99	HER-14	06/22/99	Det
97	06/15/99	HER-14D	06/23/99	Det
98	06/15/99	MRE-14	06/23/99	Det
99	06/15/99	MRE-14D	06/23/99	Det
100	06/15/99	GAL-14	06/23/99	Det

Log #	Date Received	Sample Name	Analysis Date	Sample Amount (ng/sample)
101	06/15/99	GAL-14D	06/23/99	<MDL
102	06/15/99	TER-14	06/23/99	<MDL
103	06/15/99	TER-14D	06/23/99	<MDL*
104	06/15/99	ARB-15	06/23/99	Det
105	06/15/99	HER-15	06/23/99	2.47E+1
106	06/15/99	MRE-15	06/23/99	Det
107	06/15/99	GAL-15	06/23/99	Det
108	06/15/99	TER-15	06/24/99	<MDL
109	06/21/99	ARB-16	06/23/99	<MDL
110	06/21/99	HER-16	06/23/99	<MDL
111	06/21/99	MRE-16	06/23/99	<MDL
112	06/21/99	GAL-16	06/23/99	Det
113	06/21/99	TER-16	06/23/99	<MDL
114	06/21/99	ARB-17	06/23/99	<MDL
115	06/21/99	HER-17	06/23/99	Det
116	06/21/99	MRE-17	06/23/99	<MDL
117	06/21/99	GAL-17	06/23/99	<MDL
118	06/21/99	TER-17	06/23/99	<MDL*
119	06/21/99	ARB-18	06/24/99	<MDL
120	06/21/99	ARB-18D	06/24/99	<MDL
121	06/21/99	HER-18	06/24/99	2.059E+1
122	06/21/99	HER-18D	06/24/99	2.47E+1
123	06/21/99	MRE-18	06/24/99	Det
124	06/21/99	MRE-18D	06/24/99	Det
125	06/21/99	GAL-18	06/24/99	<MDL
126	06/21/99	GAL-18D	06/24/99	Det
127	06/21/99	TER-18	06/24/99	<MDL

Log #	Date Received	Sample Name	Analysis Date	Sample Amount (ng/sample)
128	06/21/99	TER-18D	06/24/99	<MDL*
129	06/21/99	TB99621	06/24/99	<MDL
130	06/21/99	ARB-19	06/24/99	<MDL
131	06/21/99	HER-19	06/24/99	Det
132	06/21/99	MRE-19	06/24/99	<MDL
133	06/21/99	GAL-19	06/24/99	<MDL
134	06/21/99	TER-19	06/24/99	<MDL
135	06/30/99	ARB-20	06/29/99	<MDL
136	06/30/99	HER-20	06/29/99	Det
137	06/30/99	MRE-20	06/29/99	Det
138	06/30/99	GAL-20	06/29/99	<MDL
139	06/30/99	TER-20	06/30/99	<MDL
140	06/30/99	ARB21		NA
141	06/30/99	HER-21	06/30/99	Det
142	06/30/99	MRE-21	06/30/99	Det
143	06/30/99	GAL-21	06/30/99	2.94E+1
144	06/30/99	TER-21	06/30/99	<MDL*
145	06/30/99	ARB-22	06/30/99	Det
146	06/30/99	ARB-22D	06/30/99	<MDL
147	06/28/99	TB99628	06/30/99	<MDL
148	06/30/99	HER-22	06/30/99	Det
149	06/30/99	HER-22D	06/30/99	Det
150	06/30/99	MRE-22	06/30/99	Det
151	06/30/99	MRE-22D	06/30/99	Det
152	06/30/99	GAL-22	06/30/99	<MDL
153	06/30/99	GAL-22D	06/30/99	Det
154	06/30/99	TER-22	06/30/99	<MDL

Log #	Date Received	Sample Name	Analysis Date	Sample Amount (ng/sample)
155	06/30/99	TER-22D	06/30/99	<MDL*
156	06/30/99	ARB-23	06/30/99	<MDL
157	06/30/99	HER-23	06/30/99	<MDL
158	06/30/99	MRE-23	06/30/99	<MDL
159	06/30/99	GAL-23	06/30/99	<MDL
160	06/30/99	TER-23	06/30/99	<MDL
161	06/30/99	ARB-24	07/14/99	<MDL
162	06/30/99	HER-24	07/14/99	Det
163	06/30/99	MRE-24	07/14/99	Det
164	06/30/99	GAL-24	07/14/99	Det
165	06/30/99	TER-24	07/14/99	<MDL
166	06/30/99	TB99629	07/14/99	<MDL

NOTES
*Average of two analyses

If analysis result is $\geq$ MDL and < EQL it is reported in the table as detected (DET). Levels $\geq$ EQL of 22.0 ng/sample are reported as the actual measured value and were reported to three significant figures.

<MDL = Atrazine less than 4.41 ng/sample
Det = Atrazine amount $\geq$ 4.41 ng/sample and < 22.0 ng/sample (EQL).

Table 3: Laboratory solvent blanks

Sample Name	Date	Atrazine (ng/sample)
B9052707	05/27/99	DET [1]
B9060207	6/02/99	<MDL [2]
B9060807	6/08/99	<MDL
B9062207	6/22/99	DET
B9062307	6/23/99	DET
B9062907	6/29/99	<MDL
B9071407	7/14/99	DET

[1]DET = Amount between 4.41 ng/sample and 22.0 ng/sample.
[2]<MDL = Amount less than 4.41 ng/sample.

Table 4: Laboratory Control Spike Results

Sample Name	Date Analyzed	Atrazine Amount (ng/sample)	Atrazine Expected (ng/sample)	Percent Recovery	Relative difference
LCS-1	5/27/99	313	300	105%	
LCS-2	5/27/99	318	300	106%	1.41%
LCS-3	6/02/99	283	300	94.4%	
LCS-4	6/02/99	289	300	96.2%	1.88%
LCS-5	6/08/99	307	300	102%	
LCS-6	6/08/99	348	300	116%	12.5%
LCS-9	6/22/99	272	300	90.5%	
LCS-10	6/22/99	265	300	88.4%	2.36%
LCS-11	6/23/99	271	300	90.5%	
LCS-12	6/23/99	283	300	94.2%	4.05%
LCS-13	6/29/99	293	300	97.7%	
LCS-14	6/29/99	334	300	111%	13.0%
LCS-19	7/14/98	262	300	87.4%	
LCS-20	7/14/98	318	300	106%	19.4%

Relative Difference = 100*(sample1-sample2)/average

Table 5: Laboratory Control Blank Results

Sample Name	Date Analyzed	Atrazine Amount (ng/sample)
LCB-1	5/27/99	<MDL[1]
LCB-2	6/02/99	<MDL
LCB-3	6/08/99	<MDL
LCB-5	6/22/99	<MDL
LCB-6	6/23/99	<MDL
LCB-7	6/29/99	<MDL
LCB-10	7/14/99	<MDL

[1]<MDL=Amount less than 4.41 ng/sample

Table 6: Calibration Check Sample Results

Sample Name	Date Run	Atrazine Amount (ng/sample)	Atrazine Expected (ng/sample)	Percent Recovery
CC0052707	5/28/99	307	300	100%
CC9005281	5/28/99	310	300	103%
CC906021	6/03/99	296	300	98.5%
CC906022	6/03/99	307	300	102%
CC906023	6/03/99	294	300	97.9%
CC906081	6/09/99	292	300	97.2%
CC906082	6/09/99	305	300	102%
CC906083	6/09/99	308	300	103%
CC906221	6/22/99	286	300	95.4%
CC906222	6/23/98	288	300	95.9%
CC906223	6/23/99	310	300	103%
CC906231	6/24/99	300	300	99.8%
CC906232	6/24/99	303	300	107%
CC906233	6/24/99	300	300	100%
CC906291	6/30/99	319	300	106%
CC906292	6/30/99	312	300	104%
CC906293	6/30/99	298	300	99.2%
CC907141	7/15/99	298	300	99.2%
CC907142	7/15/99	296	300	98.5%

Table 7: Duplicate analysis results (ng/sample)

Sample Name	Atrazine Amount	Average	Relative Difference
TER-3	<MDL[1]		
TER-3	<MDL	NQ[3]	NC[4]
TER-6	<MDL		
TER-6	<MDL	NQ	NC
TER-7D	<MDL		
TER-7D	<MDL	NQ	NC
TER-9	<MDL		
TER-9	<MDL	NQ	NC
HER-11	DET[2]		
HER-11	DET	NQ	NC
TER-13	<MDL		
TER-13	<MDL	NQ	NC
TER-14D	<MDL		
TER-14D	<MDL	NQ	NC
TER-17	<MDL		
TER-17	<MDL	NQ	NC
TER-18D	<MDL		
TER-18D	<MDL	NQ	NC
TER-21	<MDL		
TER-21	<MDL	NQ	NC
TER-22D	<MDL		
TER-22D	<MDL	NQ	NC

[1]MDL= >4.41 ng/sample
[2]DET= ≥4.41 ng/sample but ≤ 22.0 ng/sample
[3]NQ= not quantitated
[4]NC= not calculated
Relative Difference = 100*(analysis1-analysis2)/average

Table 8: Laboratory Spikes Results

Sample Name	Date Spiked	Date Analyzed	Atrazine Amount (ng/sample)	Amount Atrazine Spiked (ng/sample)	Percent Recovery
ASS0528-1	5/28/99	6/8/99	283	300	94.5%
ASS0528-1	5/28/99	6/8/99	284	300	94.8%
ASS0528-1	5/28/99	6/8/99	286	300	95.4%
ASS0528-1	5/28/99	6/8/99	267	300	89.0%

Table 9: Trip Spike Results

Sample Name	Date Spiked	Date Analyzed	Atrazine Amount (ng/sample)	Amount Atrazine Spiked (ng/sample)	Percent Recovery
TS-1	5/28/99	6/8/99	289	300	96.2%
TS-2	5/28/99	6/8/99	307	300	100%
TS-3	5/28/99	6/8/99	324	300	108%
TS-4	5/28/99	6/8/99	288	300	96.0%

Table 10: Field Spike Results

Sample Name	Colocated sample ID	Date Analyzed	Atrazine Amount in Sample (ng/sample)	Amount Atrazine in collocated sample (ng/sample)	Percent Recovery
AFS0528-1	ARB-9	6/9/99	284	<MDL	94.5%
AFS0528-2	ARB-9	6/9/99	274	<MDL	91.2%
AFS0528-3	ARB-9	6/9/99	263	<MDL	87.8%
AFS0528-4	ARB-9	6/9/99	285	<MDL	94.9%
AFS0528-4	ARB-11	6/9/99	263	<MDL	87.5%
AFS0528-4	ARB-11	6/9/99	288	<MDL	96.0%

<MDL = Amount less than 4.41 ng/sample

Table 11: Trip Blank Results

Sample Name	Date Analyzed	Atrazine Amount (ng/sample)
TB990526	6/03/99	<MDL[1]
TB99601	6/09/99	<MDL
TB99615	6/23/99	<MDL
TB99621	6/24/99	<MDL
TB99628	6/30/99	<MDL
TB99629	7/14/99	<MDL

[1]<MDL=Amount less than 4.41 ng/sample

Table 12 Application Monitoring Results

Log #	Date Received	Sample Name	Analysis Date	Results ng/sample
1	6/14/99	NB	6/16/99	Det
2	6/14/99	NFS1	6/16/99	3.23E+2
3	6/14/99	SB	6/16/99	Det
4	6/14/99	SFS2	6/16/99	2.99E+2
5	6/14/99	WB	6/16/99	Det
6	6/14/99	WFS3	6/16/99	2.62E+2
7	6/14/99	EB	6/16/99	4.64E+1
8	6/14/99	EFS4	6/16/99	3.35E+2
9	6/14/99	TS1	6/16/99	2.65E+2
10	6/14/99	TS2	6/16/99	3.03E+2*
11	6/14/99	TS3	6/17/99	2.80E+2
12	6/14/99	TS4	6/17/99	3.05E+2
13	6/14/99	S1	6/17/99	Det
14	6/14/99	E1	6/17/99	Det
15	6/14/99	E1D	6/17/99	Det
16	6/14/99	W1	6/17/99	<MDL
17	6/14/99	N1	6/17/99	Det
18	6/14/99	S2	6/17/99	<MDL
19	6/14/99	E2	6/17/99	5.21E+1
20	6/14/99	E2D	6/17/99	2.70E+1*
21	6/14/99	W2	6/17/99	<MDL
22	6/14/99	N2	6/17/99	<MDL
23	6/14/99	S3	6/17/99	Det
24	6/14/99	E3	6/17/99	Det
25	6/14/99	E3D	6/17/99	Det

Log #	Date Received	Sample Name	Analysis Date	Results ng/sample
26	6/14/99	W3	6/17/99	Det
27	6/14/99	N3	6/17/99	<MDL
28	6/14/99	S4	6/18/99	7.37E+1
29	6/14/99	E4	6/18/99	7.44E+1
30	6/14/99	E4D	6/18/99	7.47E+1*
31	6/14/99	W4	6/18/99	Det
32	6/14/99	N4	6/18/99	3.16E+1
33	6/14/99	S5	6/18/99	2.83E+1*
34	6/14/99	E5	6/18/99	1.69E+2
35	6/14/99	E5D	6/18/99	8.77E+1
36	6/14/99	W5	6/18/99	Det
37	6/14/99	N5	6/18/99	3.96E+1
38	6/14/99	S6	6/18/99	4.78E+1
39	6/14/99	E6	6/18/99	3.72E+1
40	6/14/99	E6D	6/17/99	4.61E+1
41	6/14/99	W6	6/17/99	3.10E+1
42	6/14/99	N6	6/18/99	<MDL
43	6/14/99	S7	6/18/99	Det
44	6/14/99	E7	6/18/99	8.22E+1*
45	6/14/99	E7D	6/18/99	7.76E+1
46	6/14/99	W7	6/18/99	3.75E+1
47	6/14/99	N7	6/18/99	<MDL
48	6/14/99	S8	6/18/99	Det
49	6/14/99	E8	6/18/99	Det
50	6/14/99	E8D	6/18/99	Det

Log #	Date Received	Sample Name	Analysis Date	Results ng/sample
51	6/14/99	W8	6/18/99	3.43E+1
52	6/14/99	N8	6/18/99	4.12E+1
53	6/14/99	S9	6/18/99	Det
54	6/14/99	E9	6/18/99	1.17E+2*
55	6/14/99	E9D	6/18/99	1.15E+2
56	6/14/99	W9	6/18/99	5.18E+1
57	6/14/99	N9	6/18/99	1.20E+2
58	6/14/99	TB	6/17/99	<MDL

NOTES
*Average of two analyses

If analytical results is ≥ MDL and < EQL it is reported in the table as detected (DET). Levels equal to or greater than the EQL of 22.0 ng/sample are reported as the actual measured value and were reported to three significant figures.

<MDL = Atrazine less than 4.41 ng/sample
Det = Atrazine amount equal to or greater than 4.41 ng/sample and less than 22.0 ng/sample. (EQL).

Table 13: Laboratory solvent blanks

Sample Name	Date	Atrazine Amount (ng/sample)
B9907607	6/16/99	DET[1]
B9907707	6/17/99	DET

[1]DET = Amount ≥4.41 ng/sample and <22.0 ng/sample

Table 14: Laboratory Control Spike Results

Sample Name	Date Analyzed	Atrazine Amount (ng/sample)	Atrazine Expected (ng/sample)	Percent Recovery	Relative difference
LC-4	6/18/99	282	300	94.1%	
LC-5	6/18/99	307	300	100%	6.54%

Relative Difference = 100*(sample1-sample2)/average

Table 15: Laboratory Control Blank Results

Sample Name	Date Analyzed	Atrazine Amount (ng/sample)
LB-8	6/18/99	<MDL*

*<MDL = Amount < 4.41 ng/sample

Table 16 : Calibration Check Sample Results

Sample Name	Date Run	Atrazine Amount (ng/sample)	Atrazine Expected (ng/sample)	Percent Recovery
C9906161	6/16/99	291	300	97.1%
C9906163	6/17/99	309	300	103%
C9906164	6/17/99	320	300	107%
C990671	6/18/99	313	300	104%
C9906173	6/18/99	286	300	95.3%
C9906174	6/18/99	308	300	103%
C9906175	6/18/99	305	300	102%

Table 17: Duplicate analysis results

Sample Name	Atrazine Amount (ng/sample)	Average (ng/sample)	Relative Difference
E2D	23.1		
E2D	31.4	27.3	30.5%
E7	83.9		
E7	80.5	82.2	4.12%
E9	116		
E9	117	117	0.180%
E4D	76.5		
E4D	72.8	74.7	4.94%
S5	28.9		
S5	27.7	28.3	4.13%
TS2	300		
TS2	305	303	1.78%

Relative Difference = 100*(analysis1-analysis2)/average

Table 18: Laboratory Spikes Results

Sample Name	Date Spiked	Date Analyzed	Atrazine Amount (ng/sample)	Amount Atrazine Spiked (ng/sample)	Percent Recovery
LS-1	05/28/99	6/17/99	257	300	85.6%
LS-2	05/28/99	6/17/99	281	300	93.7%
LS-3	05/28/99	6/17/99	299	300	99. 5%
LS-4	05/28/99	6/17/99	264	300	88.0%

Table 19: Trip Spike Results

Sample Name	Date Spiked	Date Analyzed	Atrazine Amount (ng/sample)	Amount Atrazine Spiked (ng/sample)	Percent Recovery
TS-1	05/28/99	6/16/99	265	300	103%
TS-2*	05/28/99	6/16/99	303	300	107%
TS-3	05/28/99	6/16/99	280	300	93.3%
TS-4	05/28/99	6/16/99	305	300	102%

*Average of two analyses

Table 20: Field Spike Results

Sample Name	Collocated Application Sample	Date Analyzed	Atrazine Amount Spiked in Sample (ng/sample)	Amount Atrazine in collocated sample (ng/sample)	Percent Recovery
EFS4	EB	6/16/99	334	46.4	96.0%
NFS1	NB	6/16/99	323	14.3	103%
SFS2	NB	6/16/99	299	10.1	96.4%
WFS3	WB	6/16/99	262	9.84	84.0%

Table 21: Blank Resin Results

Sample Name	Atrazine Amount (ng/sample)
EFS4-B	<MDL*
NFS1-B	<MDL
SFS2-B	<MDL
WFS3-B	<MDL

*<MDL = Amount ≤ 4.41 ng/sample

Appendix I: Standard Operating Procedure

Atrazine Method Development and Atrazine Analytical Results for Ambient Monitoring and Application Samples

Evaluation Section
Engineering and Laboratory Branch
Monitoring and Laboratory Division

Standard Operating Procedure

Sampling and Analysis of Atrazine in Ambient Air

2/04/2000 Version

Approved
Michael P. Spears, Manager

Standard Operating Procedure: Sampling and analysis of Atrazine in ambient air

1. SCOPE

This is a sorbent tube, solvent extraction, gas chromatography/mass spectrometry method for the determination of atrazine from ambient air samples.

2. SUMMARY OF METHOD

The exposed XAD-2 resin tubes (SKC #226-30-06) are stored in an ice chest on dry ice or freezer until desorbed during sonication into 3.0 ml of 50:50 ethyl acetate/acetone. The sorbent is spiked with 300ng of atrazine-$^{13}C_3$ prior to extraction. The splitless injection volume is 1 μl. A gas chromatograph with a capillary column (95% methyl 5% phenyl silicone stationary phase) and a quadrapole mass spectrometer (MS) is used for analysis. The MS detector is operated in selected ion monitoring mode.

3. INTERFERENCES/LIMITATIONS

Method interference's may be caused by contaminants in solvents, reagents, glassware and other processing apparatus that can lead to discrete artifacts or elevated baselines. Co-eluting compounds trapped during sample collection may also interfere. A method blank must be done with each batch of samples to detect any possible method interferences.

4. EQUIPMENT AND CONDITIONS

A. INSTRUMENTATION:

Hewlett Packard 6890 chromatograph
Hewlett Packard 5973 mass selective detector
Hewlett Packard 7683 Autosampler

Detector: 280°C
Injector: 225°C
Injector Liner: Goose neck liner with glass wool
Column: J&W DB-5MS, 30 meter, 0.25 mm i.d., 0.25 um film thickness.

Pre-column: Restek deactivated fused silica, 2 meter, 0.25 mm i.d.

GC Temp. Program: Initial 50°C, hold 3 min., to 300°C @ 15°C/min

Injector:
Pressure Initial 9.5 psi constant flow mode
Splitless: Purge on 2.0 min.
Carrier Gas: Helium
Column: Linear velocity: 38 cm/sec, electronic pressure control (9.5 psi @ 50 °C).

Auto Sampler:
Sample washes - 1, Sample pumps - 4, Sample Volume - 4 stops, Viscosity delay - 0 sec, Solvent A washes - 4, Solvent B washes - 4

Mass Spectrometer:
Electron Ionization
Selective Ion Monitoring; atrazine - 200 (quant. ion, 100%), 215 (qual. ion, 20%), 173 (qual. ion, 25%). atrazine-$^{13}C_3$ - 205 (quant. ion, 100%), 220 (qual. ion, 40%), Tuning: PFTBA

B. AUXILIARY APPARATUS:

1. Glass amber vials, 8 mL capacity.
2. Vial Shaker, SKC, or equiv.
3. Sonicator, Branson 2210
4. Autosampler vials with septum caps.

C. REAGENTS

1. Ethyl Acetate, Pesticide Grade or better
2. Acetone, Pesticide Grade or better
3. Atrazine 98% pure or better (e.g., from Chem Service).
4. Atrazine-$^{13}C_3$ 99% pure or better (e.g., from Cambridge Isotope Laboratories)

5. ANALYSIS OF SAMPLES

1. A daily manual tune shall be performed using PFTBA. The instrument is tuned using masses - 69, 219, 502. The criterion for the tune are the peak widths at 1/2 the peak height, 0.50 $\pm$ .05, and the criteria for relative abundance; 69:100%; 219:100%-120%, and 502:6%-11%.

2. It is necessary to analyze a solvent blank with each batch of samples. Staff defines a batch as the samples in an automated GC/MS analysis sequence.

The blank must be free of interferences. A solvent blank must be analyzed after any sample, which results in possible carry-over contamination.

3. A 5 point calibration curve shall be analyzed with each batch of samples.

4. A laboratory control blank and two laboratory control spike samples will be run with each set of samples. A set of samples is a group of samples prepared during the same time period. A laboratory control blank is a blank resin cartridge prepared and analyzed the same way the samples are analyzed. A laboratory control spike is a resin cartridge spiked with a known amount of standard. The control sample is prepared and analyzed the same way as the samples. Laboratory control spike samples need to be within 40% (100*difference/average) of each other and have recoveries that are +/- 30% of the theoretical spiked value.

5. At least one calibration check sample must be analyzed for each batch of 10 samples analyzed. The response of the standard must be within 20% of the initial calibration analyses for the batch. If the calibration check is outside the limit then those samples in the batch after the last calibration check that was within the 20% limit need to be reanalyzed.

6. Carefully score the secondary section end of the sampled XAD-2 tube above the glasswool and break at the score. Remove the glass wool plug from the secondary end of the XAD-2 tube with forceps and place it into a 4 mL amber colored sample vial. Pour the backup portion of the XAD-2 into the same vial. Remove the middle glass wool plug and store in the 4 mls amber vial. Retain the secondary section of the XAD-2 tube for later analysis if needed to check the possibility of breakthrough.

7. Spike the back end of the primary XAD tube with 15.0 µl of 20 ng/ml atrazine -$^{13}C_3$. Let the solvent evaporate for approximately 10 minutes. Pour the primary XAD into a 8 ml vial. Remove the glasswool plug from the tube and put into the 8 ml vial. Rinse the tube with 3.0 mls of a 50:50 (vol) solution of ethyl acetate and acetone and pour the rinse into the 8 ml vial.

8. Place the sample vial on a desorption shaker (or ultra sonic water-bath) for 30 minutes. Remove vial and store at -20°C until analysis. Transfer an 285 µl aliquot to a GC autosample vial. Then add 15 µl of 20 ug/ml malathion-D_{10} recovery standard to the GC autosample vial prior to analysis.

9. After calibration of the GC system, inject 1.0 µL of the extract. If the resultant peak for atrazine has a measured concentration greater than that of the highest standard injected, dilute the sample and re-inject.

10. Calculate the concentration in ng/ml based on the data system calibration curve. If the sample has been diluted, multiply the calculated concentration by the dilution factor.

11. The atmospheric concentration is calculated according to:

    Conc., ng/m^3 = (Extract Conc., ng/mL X 3.0 mL) /Air Volume Sampled, m^3

6. QUALITY ASSURANCE

A. INSTRUMENT REPRODUCIBILITY

Five (5) injections of 1 μl each were made of atrazine standards at three concentrations in order to establish the reproducibility of this instrument.

B. CALIBRATION

Linearity

A linear regression was performed on a 25 ng/ml-400ng/ml 5-point calibration.

Resp Ratio = (3.21)*Amt - 0.326

R^2 = 1.000

Calibration Check

A calibration check sample is run after every tenth sample in a batch to verify the system is still in calibration. Calibration check samples must be within 20% of the assigned value. If the check sample is outside that range then the ten samples within that sample batch will be rerun.

C. MINIMUM DETECTION LIMIT

Detection limit is based on USEPA MDL calculation. Using the analysis of seven low level matrix spikes (12.5pg/ml), the method detection limit (MDL), and the estimated quantitation limit (EQL) for atrazine were calculated by:

MDL = 3.14*s

EQL = 5*MDL

where:

s = the standard deviation of the concentration calculated for the seven replicate spikes.

For the seven atrazine replicate spikes, the standard deviation ,s, was determined to be 0.441, thus

MDL = 3.14 *(0.441) = 1.47 ng/ml (4.41 ng/sample). The EQL or estimated quantitation level equals 5 times the MDL then,
EQL= 5 *1.47 = 7.34 ng/ml (22.0 ng/sample)

The lowest ambient concentration that can be quantitated is calculated by multiplying the EQL by the total extraction volume of 3 ml divided by the total volume of air collected. The total mass of the sample at the EQL is (3mL)*(7.34ng/mL) = 22.0 ng/sample. The amount of air collected for a 24 hour period with a flow rate of 3 liter per minute is 4.32 m^3. The ambient air concentration at the EQL can be determined by dividing the total sample mass by the total volume of air collected.

(22.0ngs) / (4.32 m^3) = 4.81 ng/m^3 per 24-hour sample

Results above the EQL are reported to 3 significant figures. Results below the EQL but greater than or equal to the MDL are reported as detected (DET) Results less than MDL are reported as <MDL.

D. COLLECTION AND EXTRACTION EFFICIENCY (RECOVERY)

The primary section of three (3) XAD-2 sampling tubes were spiked with 125 ng of atrazine standard and the primary section of three (3) XAD-2 tubes were spiked with 1000ng of atrazine standard. The spiked tubes were sampled with ambient air at a flowrate of 3 lpm for 24 hours. The primary sections were extracted with a 50:50 mixture of ethyl acetate/acetone and the extracts were stored in the freezer until analyzed. The average percent recoveries from the primary sections spiked with 125 ng of atrazine was 104% with a relative standard deviation of 7.57% and the average percent recoveries of the primarly sections spiked with1000 ng of atrazine was 90.4%, with an relative standard deviation of 10.4%.

E. STORAGE STABILITY

Storage stability studies were conducted over an 8 week period. The primary sections of twelve (12) tubes were spiked with 125 ng of atrazine. The spiked

tubes were stored in the freezer at -20^{0}C and extracted/analyzed on storage weeks 0, 2, 4 and 8. The storage recoveries (average results) were 112%, 101%, 119%, and 104% for weeks 0, 2, 4, and 8 respectively.

A second set of tubes were spiked with 1000 ng of atrazine. The spiked tubes were stored in the freezer at -20^{0}C and extracted/analyzed on storage weeks 0, 2, 4 and 8. Three (3) tubes each were analyzed on week 0, 2, 4, and 8. The storage recoveries (average results) were 102%, 84.8%, 119%, 105% for weeks 0, 2, 4, and 8 respectively.

F. BREAKTHROUGH

The primary sections of three (3) tubes were spiked with 5000 ng atrazine were run for 24 hours at 3 lpm. No atrazine was detected in the back-up resin bed of any of the tubes.

G. SAFETY

Atrazine is slightly to moderately toxic to humans and other animals. OSHA and NIOSH time weighted average is 5 mg/m^3. This procedure does not address all of the safety concerns associated with the chemical analysis. For more hazard information and guidance the analyst is referred to the material safety data sheets and other appropiate safety material.

APPENDIX III

PESTICIDE USE REPORT

STATE OF CALIFORNIA

PRODUCTION AGRICULTURE MONTHLY PESTICIDE USE REPORT : MULTIPLE SITE/COMMODITY

PR-ENF-103 (EST. 10/91)

SEE INSTRUCTIONS ON THE REVERSE OF THIS FORM

DEPARTMENT OF PESTICIDE REGULATION
PESTICIDE ENFORCEMENT BRANCH

№ 340014

1. MONTH	2. YEAR	3. NURSERY	4. COUNTY NO.
June	1999	☐	34

5. SECTION	6. TOWNSHIP	7. RANGE	8. BASE & MERIDIAN	9. OPERATOR ID / PERMIT NO.	10. OPERATOR (GROWER)	11. ADDRESS	12. CITY	13. ZIP CODE
	6 N	6 E	M	3499 3400549	James Pellandini	12200 Stockton Blvd	Galt	95632

14. SITE IDENTIFICATION NUMBER	15. DATE AND TIME APPLICATION	16. COMMODITY / SITE TREATED	17. TOTAL PLANTED ACRES	18. TOTAL TREATED ACRES	19. APP METHOD (CHECK ONE)	20. EPA / CALIF REG. NO. FROM LABEL 00100-00585-AA	21. TOTAL PRODUCT USED (CIRCLE ONE UNIT OF MEASURE)	22. RATE PER ACRE	23. DILUTION	24. DAYS REENTRY	25. MANUFACTURER / NAME OF PRODUCT
26 Home		Sorghum/Sudan	53	53	GR ☑ AIR ☐ OTHER ☐	00100-00585-AA	116.6 LB OZ PT QT GA	2.2 lbs	25	12 hrs	AATREX Nine-O
27 Home		Sorghum/Sudan	68	68	GR ☑ AIR ☐ OTHER ☐	00100-00585-AA	149.6 LB OZ PT QT GA	2.2 lbs	25	12 hrs	AATREX Nine-O
					GR ☐ AIR ☐ OTHER ☐		LB OZ PT QT GA				
					GR ☐ AIR ☐ OTHER ☐		LB OZ PT QT GA				
					GR ☐ AIR ☐ OTHER ☐		LB OZ PT QT GA				
					GR ☐ AIR ☐ OTHER ☐		LB OZ PT QT GA				
					GR ☐ AIR ☐ OTHER ☐		LB OZ PT QT GA				
					GR ☐ AIR ☐ OTHER ☐		LB OZ PT QT GA				
					GR ☐ AIR ☐ OTHER ☐		LB OZ PT QT GA				
					GR ☐ AIR ☐ OTHER ☐		LB OZ PT QT GA				

REPORT PREPARED BY Matt Kuil DATE 6-25-99

REVIEWED BY ______ FOR AGENCY USE ONLY

8 1

APPENDIX IV

DPR's
AIR MONITORING RECOMMEDATIONS FOR ATRAZINE

Peter M. Rooney
Secretary for Environmental Protection

Department of Pesticide Regulation

James W. Wells, Director
830 K Street • Sacramento, California 95814-3510 • www.cdpr.ca.gov

Pete Wilson
Governor

MEMORANDUM

TO: George Lew, Chief
Engineering and Laboratory Branch
Air Resources Board

FROM: Douglas Y. Okumura, Acting Assistant Director
Division of Enforcement, Environmental Monitoring
and Data Management
(916) 324-4100

DATE: November 4, 1998

SUBJECT: ATRAZINE AIR MONITORING

Attached is the Department of Pesticide Regulation's (DPR) recommendation for monitoring the pesticide atrazine. DPR provides this recommendation pursuant to the requirements of the Toxic Air Contaminant Act. DPR bases its air monitoring recommendations on historical atrazine use information. Therefore, we request that you consult with the agricultural commissioner in the county where air monitoring will be conducted to select appropriate sites. We also recommend you contact DPR 30 to 60 days prior to monitoring for updated pesticide use information.

We anticipate submission of air monitoring data by May 2000.

If you have any questions please contact Pam Wales, of my staff, at (916) 322-3877.

Attachment

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California Department of Pesticide Regulation
Environmental Monitoring and Pest Management Branch

Staff Report

USE INFORMATION AND AIR MONITORING RECOMMENDATION FOR THE PESTICIDE ACTIVE INGREDIENT ATRAZINE

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USE INFORMATION AND AIR MONITORING RECOMMENDATION FOR THE PESTICIDE ACTIVE INGREDIENT ATRAZINE

A. BACKGROUND

This recommendation contains general information regarding the physical-chemical properties and the historical uses of atrazine. The Department of Pesticide Regulation (DPR) provides this information to assist the Air Resources Board (ARB) in their selection of appropriate locations for conducting pesticide air monitoring operations.

Table 1 describes some of the physical-chemical properties of atrazine.

Table 1. Some Physical-Chemical Properties of Atrazine

Chemical name	6-chloro-N^2-ethyl-N^4-isopropyl-1,3,5-triazine-2,4-diamine.
Common name	Atrazine
Some tradenames†	AATREX 4L (Ciba-Geigy), AATREX Nine-O (Ciba-Geigy), Atazine 4L (Drexel).
CAS number	1912-24-9
Molecular formula	$C_8H_{14}N_5Cl$
Molecular weight	215.7
Form	Colorless powder or white crystalline
Solubility	Water: 3.25×10^1 mg/L at 22 °C (Kollman and Segawa) Methanol: 15 g/L at 25 °C (Tomlin) Ethyl acetate: 24 g/L at 25 °C (Tomlin) Acetone: 31 g/L at 25 °C (Tomlin) Dichloromethane: 28 g/L at 25 °C (Tomlin) Toluene: 6.0 g/L at 25 °C (Tomlin) Hexane: 0.11 g/L at 25 °C (Tomlin) *n*-Octanol: 8.7 g/L at 25 °C (Tomlin)
Henry's constant	1.45×10^{-9} atm·m³/mol at 22 °C (Kollman and Segawa)
Vapor pressure	3.00×10^{-7} mmHg at 25 °C (Kollman and Segawa, Humburg et al.) 1.68×10^{-7} mmHg at 20 °C (Kollman and Segawa) 1.4×10^{-6} mmHg at 30 °C (Humburg et al.)
Specific gravity	1.187 at 20 °C (Humburg et al.)

† *Disclaimer: The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.*

Atrazine is moderately to highly mobile in soils, especially in soils with low clay or organic matter content. Because atrazine does not adsorb strongly to soil particles, and has a relatively long soil half-life, it is suspected to have a high potential for ground water contamination. De-adsorption from soil surfaces often occurs readily, and depends on temperature, moisture, and pH. The loss of atrazine from the soil by photodecomposition and/or volatilization depends on climate. Photodegradation and volatilization may occur to some extent if high temperatures and prolonged sunlight follow application, but these factors are probably of little significance under typical field conditions. Chemical hydrolysis followed by microbial activity accounts for atrazine's decomposition in the soil.

Atrazine's LC_{50} (96 hour) is 4.5-11.0 mg/L for rainbow trout, and 16 mg/L for bluegill sunfish. Its acute oral LD_{50} is 1869-3080 mg/kg for rats (technical grade material). In rats, atrazine's inhalation LC_{50} (4 hour) is >5.8 mg/L air.

B. USE OF ATRAZINE

As of September 1998, three products containing atrazine were registered for use in California. Atrazine is a widely-used selective herbicide for the pre-emergent , preplant, and post-emergent control of broadleaf and grassy weeds in corn, sorghum, sudangrass, rangeland, and turf sodgrass.

In California, growers use atrazine as a preemergent, preplant, or post-emergent herbicide to control broadleaf and grassy weeds in corn, sudangrass, and forest lands. It is applied to soil and activated by a small amount of moisture. Atrazine acts mainly through root absorption, and depends on moisture to move it into the root zone. Labeled atrazine use rates range from 1.2 to 2.0 pounds active ingredient per acre, with a total maximum annual use of 2.5 pounds per acre. Atrazine may be tank-mixed with other herbicides, such as metolachlor, paraquat, alachlor, glyphosate, and simazine. When tank-mixed with other herbicides, generally less atrazine is applied per acre. In conifers, atrazine may be applied at rates of 2.0 to 4.0 pounds per acre. When a range of rates are given, the labels indicate the lower rate should be used in coarsely textured soil or soil with low organic content, and the higher rates of use should be applied on finely-textured soil, or soil high in organic matter.

The label offers several methods for application, including aerial and ground broadcast (overall), and band (row). Formulated as a liquid or as water-dispersible granules, atrazine products include the Signal Word "Caution" on their labels. Atrazine is a restricted use pesticide in California because of ground and surface water concerns.

With DPR's implementation of full pesticide use reporting in 1990, all users must report the agricultural use of any pesticide to their county agricultural commissioner, who subsequently forwards this information to DPR. DPR compiles and publishes the use information in the annual Pesticide Use Report (PUR). Because of California's broad definition for agricultural use, DPR includes data from pesticide applications to parks, golf courses, cemeteries, rangeland, pastures, and rights-of-way, postharvest applications of pesticides to agricultural commodities, and all pesticides used in poultry and fish production, and some livestock applications in the PUR. DPR does not collect use information for home and garden use, or for most industrial and institutional

uses. The information included in this monitoring recommendation reflects widespread cropland applications of atrazine. Use rates were calculated by dividing the total pounds of atrazine used (where atrazine was applied to acreage) by the total number of acres treated.

According to the PUR, the total amount of atrazine used in California has remained relatively constant since 1990, ranging annually between slightly more than 36,000 to over 57,000 pounds (Table 2). The majority of California's total atrazine use occurred in ten counties; however, since 1994, use has become more concentrated in four counties—Imperial, Humboldt, Sacramento, and San Joaquin. Previous to 1995, use in San Joaquin County accounted for nearly half of all atrazine used in California. In 1995, San Joaquin County's use decreased to approximately 15 percent of the total Statewide use, while use in Imperial County grew to nearly 30 percent of total Statewide atrazine use. Preliminary 1996 and 1997 PUR data shows Imperial County's use continued to increase, along with use in both Sacramento and Humboldt Counties.

Table 2. Annual Cropland Use of Atrazine (Pounds of Active Ingredient)

County	1990	1991	1992	1993	1994	1995
Imperial	587	3,619	3,073	3,727	8,358	11,329
Sacramento	11,841	12,580	5,357	3,945	6,390	8,563
Humboldt	1,267	390	826	506	865	2,874
San Joaquin	18,657	10,943	10,046	19,598	21,429	5,494
Solano	332	325	556	882	308	468
Placer	0	529	362	0	133	692
Riverside	180	610	214	0	97	266
Tehama	164	5	17	154	1	75
Yolo	95	57	23	0	47	3
Contra Costa	4,752	0	4,353	2,731	3,538	647
Total annual cropland use in top ten counties	*37,874*	*29,057*	*24,827*	*31,543*	*41,165*	*30,411*
Percent cropland use of total use	*69*	*58*	*54*	*76*	*92*	*90*
Total California use	*57,511*	*52,909*	*48,313*	*44,485*	*46,497*	*36,201*

The commodities associated with the greatest use have also changed (Table 3). In general, atrazine use increased in sudangrass, corn for feed crops, and forest lands; while use decreased in corn grown for human consumption and along rights-of-way. According to preliminary 1996 and 1997 PUR data, applications to four commodities accounted for the majority of all atrazine used in California: sudangrass; feed corn; forest lands; and feed-crop bermudagrass.

Table 3. Annual Commodity Use of Atrazine (Pounds of Active Ingredient)

Site	1990	1991	1992	1993	1994	1995
Sudangrass (Feed Crop)	0	4,928	3,942	3,605	12,140	11,661
Corn (Feed Crop)	3,421	11,629	14,293	23,414	26,167	6,673
Forest Trees, Forest Lands	114	468	961	1,113	1,678	3,830
Bermudagrass (Feed Crop)	0	0	0	200	171	5,989
Rights-of-way	13,456	15,721	18,287	7,999	1,801	2,596
Corn (Human Consumption)	23,428	2,808	3,553	4,022	1,783	2,404
All Other Uses	1,506	1,315	573	333	510	1,088
Christmas Tree Plantations	0	0	0	61	118	231
Sorghum/Milo	9,193	9,067	2,703	665	512	798
Landscape Maintenance	4,171	5,858	3,496	2,406	1,509	638
Greenhouse/Nursery	2,924	1,114	504	677	108	292
Total	*58,213*	*52,908*	*48,312*	*44,495*	*46,497*	*36,200*

Figure 1 illustrates the historical patterns of atrazine use in Imperial County. Applications of atrazine in Imperial County began in early spring, peaked in March and April, and ended in early summer. Imperial County's applications were associated with corn primarily grown for human consumption. Figure 2 shows atrazine use patterns in Sacramento County. In Sacramento County, atrazine applications historically occurred in May and June. Sacramento County applications were associated with corn and increasingly with sudangrass. Preliminary 1996/1997 PUR data shows similar trends.

Figure 1. Monthly Atrazine Use Patterns in Imperial County (1993-1995)

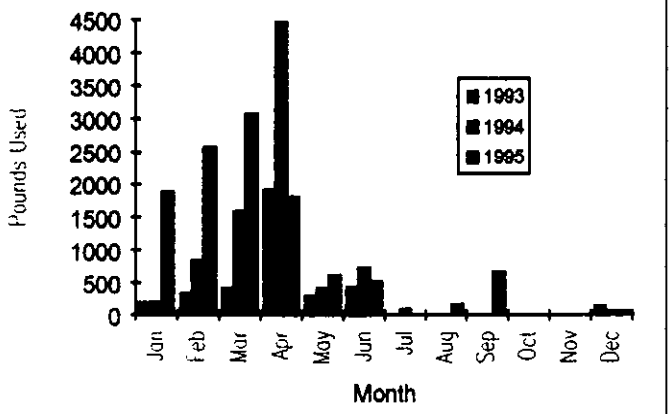
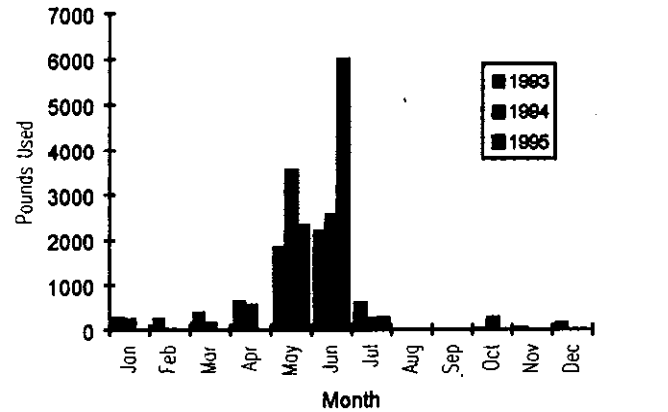


Figure 2. Monthly Atrazine Use Patterns in Sacramento County (1993-1995)



According to the PUR, most atrazine application rates are typically low, occurring at about 1.0 pound per acre. However, since 1994, some sudangrass applications ranged from 1.5 to 2.0 pounds per acre, and occurred primarily in Sacramento County. A few applications at the higher rates also occurred in San Joaquin, Placer, and Glenn Counties. According to preliminary 1996 and 1997 PUR data, the rates of use in forest areas increased significantly; rates approached

the maximum label rate. The highest rates of use in forest areas were associated with winter applications in Humboldt County.

C. RECOMMENDATIONS

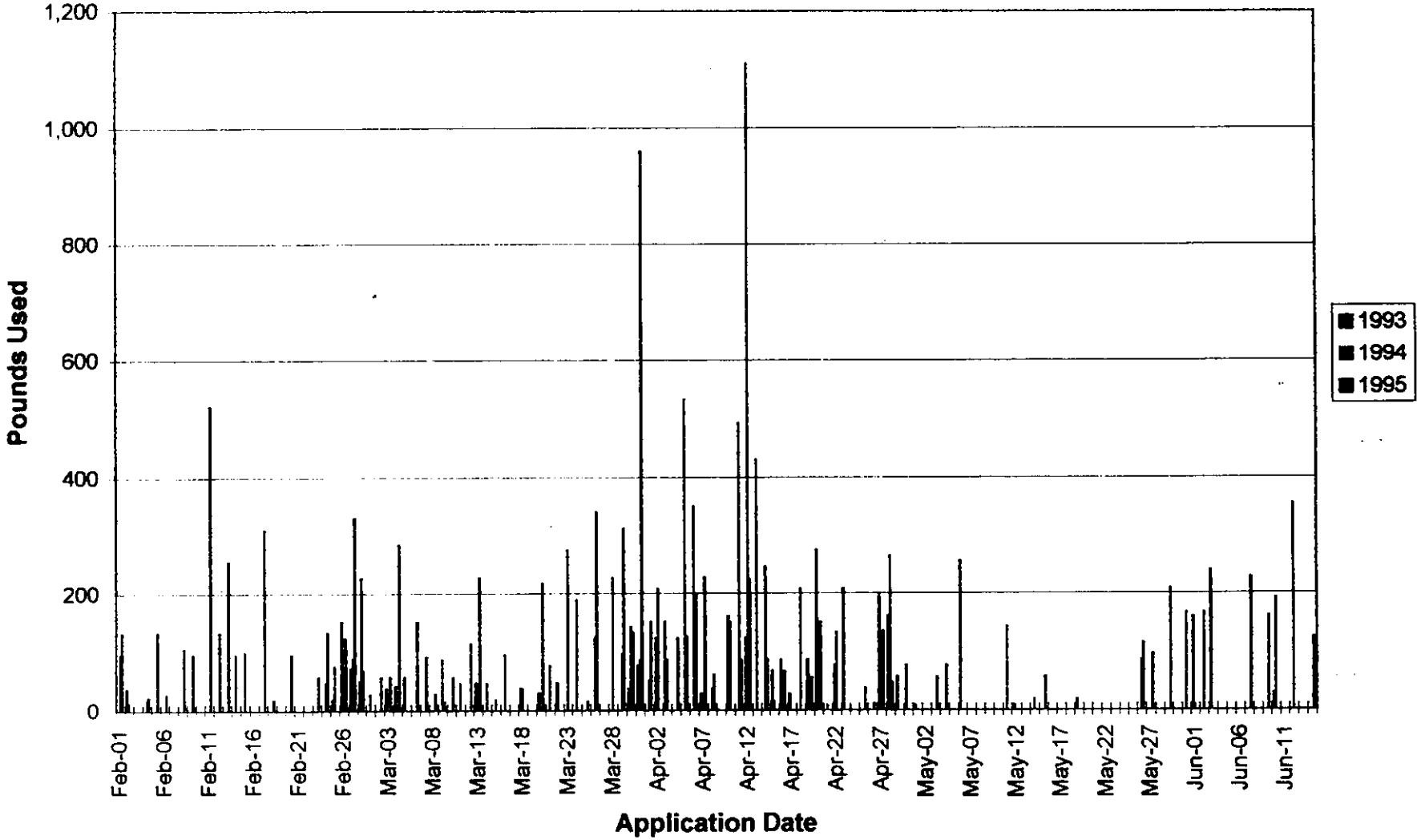
1. Ambient Air Monitoring

The historical trends in atrazine use suggest that monitoring should occur over a 30- to 45-day sampling period during the spring in Imperial County. Figure 3 shows Imperial County's applications generally began in February, reached a peak from late-March through the end of April, then tailed off throughout June. Figure 4 displays the areas of atrazine use by section in Imperial County for 1994 and 1995. Alternatively, the monitoring study could be conducted in Sacramento County during early summer. Figure 5 shows Sacramento County's applications routinely began during mid-May, peaked during late-May and early-June, then tailed off through mid-July. Figure 6 displays the areas of atrazine use by section in Sacramento County for 1994 and 1995. Three to five sampling sites should be selected in relatively high-population areas or in areas frequented by people (e.g., schools or school district offices, fire stations, or other similar public buildings). Sampling sites should be located near sudangrass and corn growing areas At each site, twenty to thirty discrete 24-hour samples should be taken during the sampling period. Background samples should be collected in an area distant to atrazine applications. A target 24-hour quantitation limit of 0.51 $\mu g/m^3$ is recommended.

DPR recommends close coordination with the county agricultural commissioner to select the best sampling sites and periods. Replicate (collocated) samples are needed for five dates at each sampling location. In addition to the primary sampler, one collocated sampler should be run on those days. The date chosen for replicate samples should be distributed over the entire sampling period. They may, but need not be, the same dates at every site. Field spike samples should be collected at the same environmental conditions (e.g., temperature, humidity, exposure to sunlight) and experimental conditions (e.g., air flow rates) as those occurring at the time of ambient sampling.

Additionally, we request that you provide in the ambient monitoring report: 1) the proximity of the sampler to treated or potentially treated fields, including the distance and direction, and 2) the distance the sampler is located above the ground.

Figure 3. Atrazine Use in Imperial County (1993-1995)



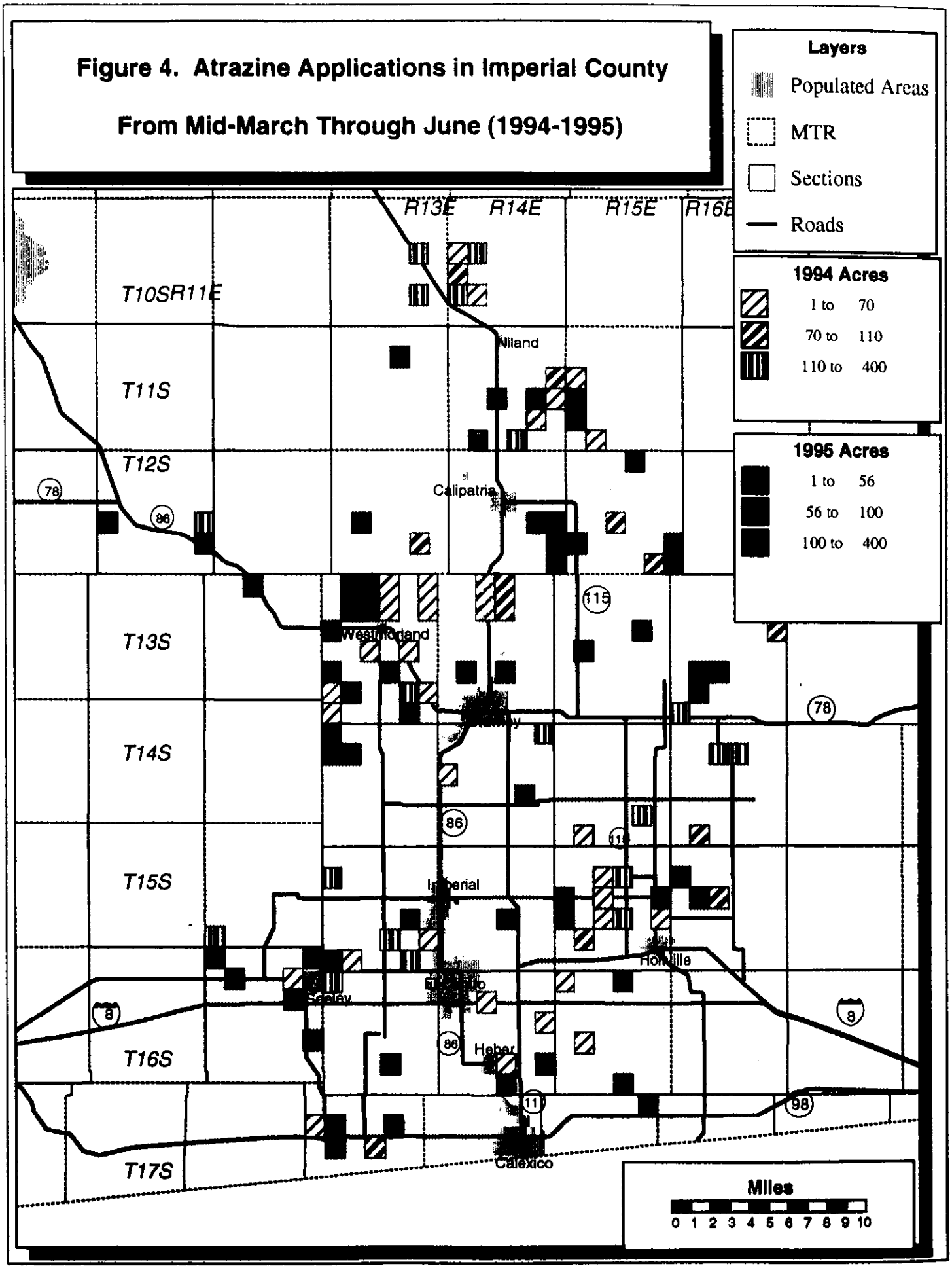
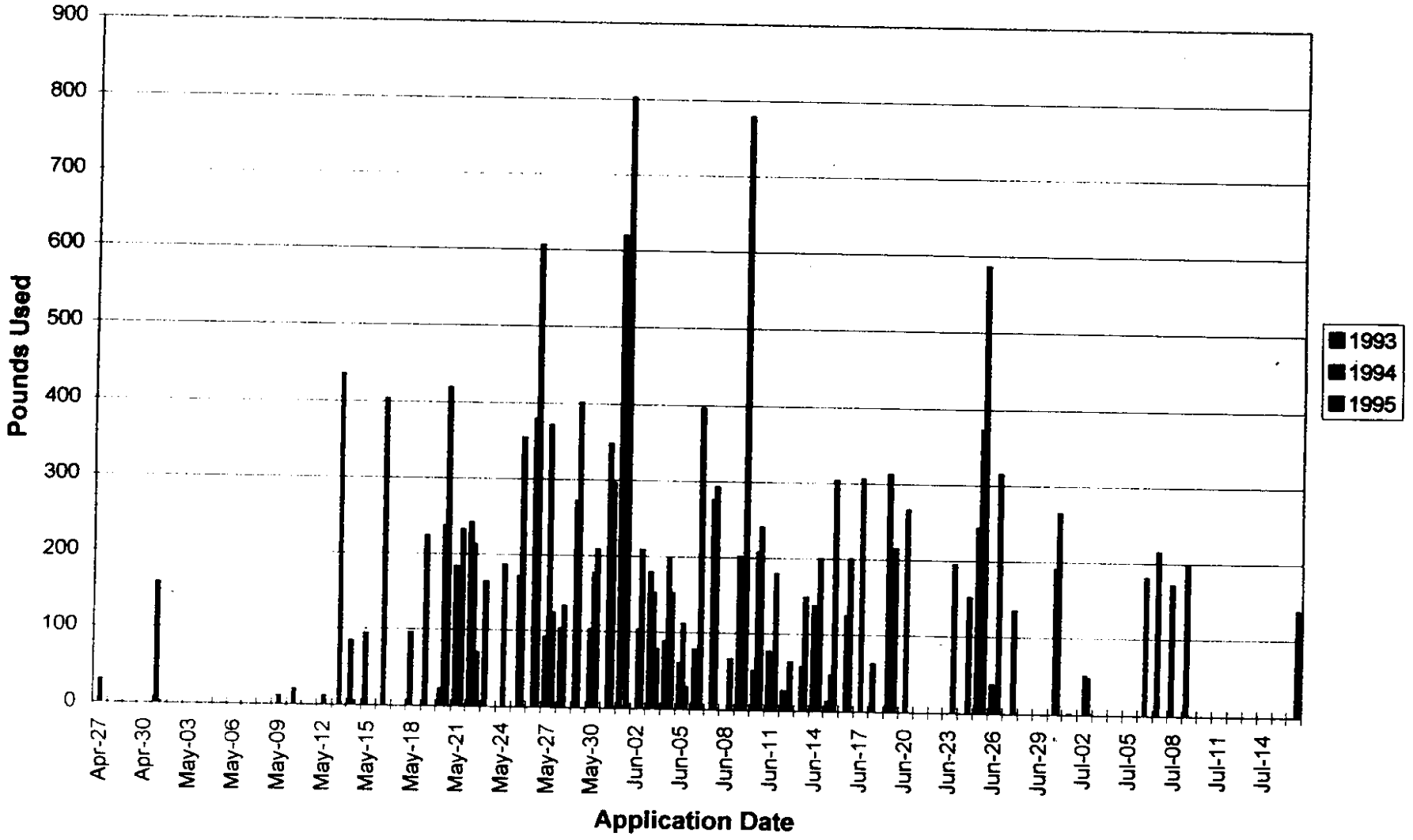


Figure 4. Atrazine Applications in Imperial County
From Mid-March Through June (1994-1995)
Layers
Populated Areas
MTR
Sections
Roads
1994 Acres
1 to 70
70 to 110
110 to 400
1995 Acres
1 to 56
56 to 100
100 to 400
R13E
R14E
R15E
R16E
T10SR11E
T11S
T12S
T13S
T14S
T15S
T16S
T17S
Niland
Calipatria
Westmorland
Imperial
Holtville
Heber
Calexico
78
86
115
8
98
Miles
0 1 2 3 4 5 6 7 8 9 10

Figure 5. Atrazine Use in Sacramento County (1993-1995)



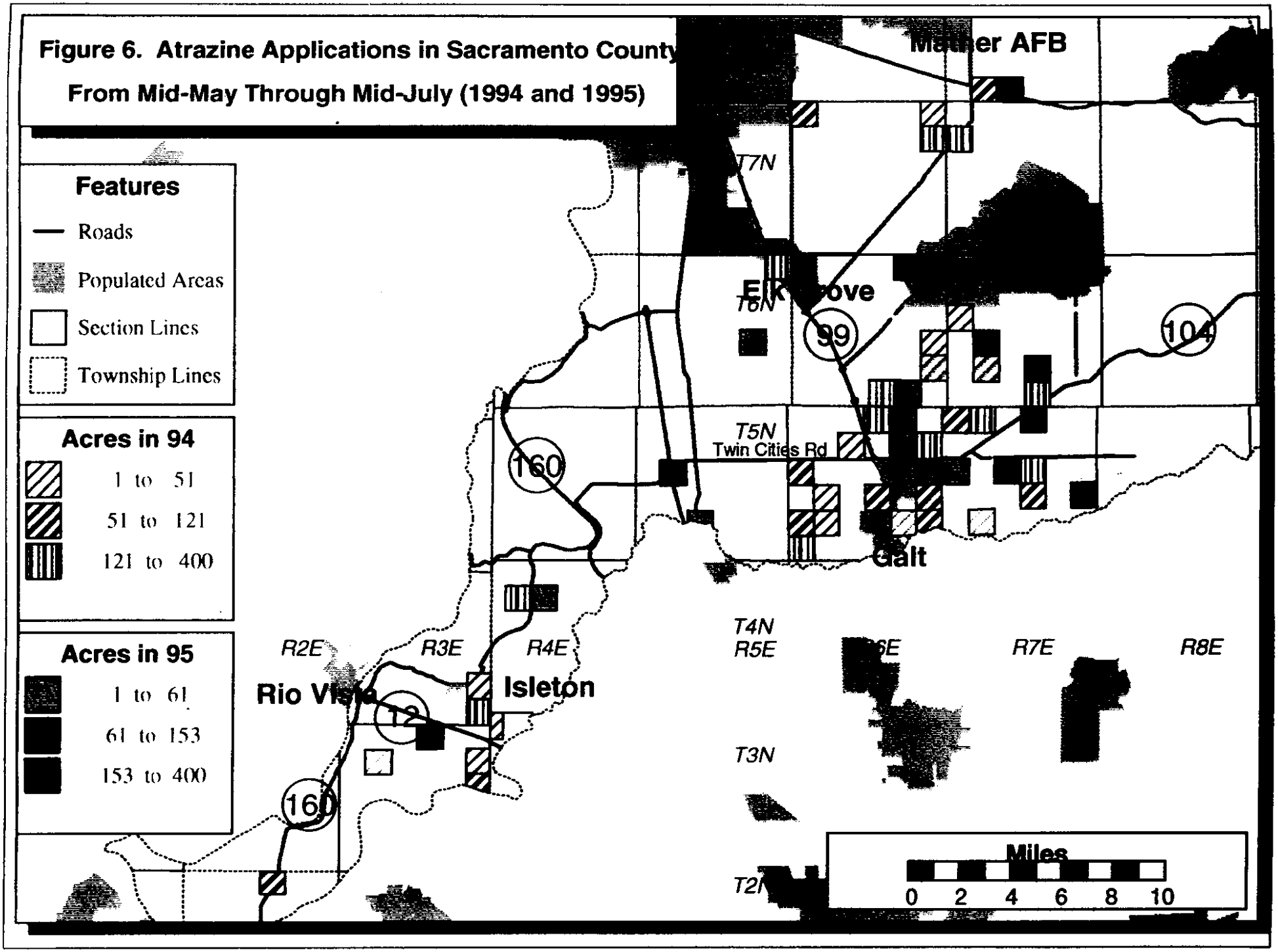


Figure 6. Atrazine Applications in Sacramento County
From Mid-May Through Mid-July (1994 and 1995)
Features
Roads
Populated Areas
Section Lines
Township Lines
Acres in 94
1 to 51
51 to 121
121 to 400
Acres in 95
1 to 61
61 to 153
153 to 400
Mather AFB
T7N
T6N
99
104
T5N
Twin Cities Rd
160
Galt
T4N
R5E
R7E
R8E
R2E
R3E
R4E
Isleton
Rio Vista
T3N
T2N
Miles
0 2 4 6 8 10

2. *Application-Site Air Monitoring*

The historical trends in atrazine use and product label information suggest that a typical agricultural application-site air monitoring study could be conducted in Sacramento during the same months as the ambient study, in association with an application to sudangrass. The label offers several methods for application, including aerial and ground broadcast (overall), and band (row). DPR does not have a preference for the type of application method monitored; however, monitoring should occur at a site using the highest rates of use; i.e., about 2.0 pounds per acre. In sudangrass, this rate occurs when atrazine is used alone and not tank-mixed with other herbicides. Although more difficult, another option would be to monitor a forest atrazine application in Humboldt County in the early winter. These forest applications occur at the highest label rates; i.e., 4.0 pounds per acre or higher during November and December. However, preliminary information suggests forest applications may decrease significantly over the next few years. If a forest application is selected for the study, DPR recommends very close consultation with both the county agricultural commissioner and DPR staff to determine if use is expected to occur, and for updated PUR information. Also, because forest trees present significant obstacles, changes may be required in the monitoring strategy (e.g., sampler position, sampling schedule, etc.), and DPR should once again be consulted.

DPR recommends close coordination with the county agricultural commissioner to select the best sampling sites and date. Ideally, the monitoring study should include samples taken before, during, and for 72 hours following application, according to the following schedule:

Sample period begins:	Sample duration time
Background (pre-application)	Minimum of 12 hours
During application	Length of application time
End of application	1 hour
1 hour post-application	2 hours
3 hours post-application[1]	3 hours (or up to 1 hour before sunset)
6 hours post-application[1]	6 hours (or up to 1 hour before sunset)
1 hour before sunset	Overnight[2] (until 1 hour after sunrise)
1 hour after sunrise	Daytime (until 1 hour before sunset)
1 hour before sunset	Overnight (until 1 hour after sunrise)
1 hour after sunrise	24-hour (until 1 hour after sunrise)

1 These samples and sample duration times may be adjusted depending on length of application time. The important issue is to take at least one 3-6 hour sample between the end of the 2-hour sample and dusk (one hour before sunset).

2 All overnight samples must include the period from one hour before sunset to one hour after sunrise.

Occasionally, a pesticide application may occur all day long over the course of two or more days. In these instances, please collect a sample during the daily application, and an overnight sample between the end of the daily application and the start of application the next morning. Following

the end of the application, begin collecting samples according to the above schedule, beginning with the 1-hour sample. Again, some sample time durations may be adjusted according to the time remaining between end of application and dusk. Regardless of application duration, the study should include at least one 1-hour sample taken immediately following the end of application, at least one 2-4 hour sample (taken following the 1-hour sample), and all overnight samples must include the time period from one hour before sunset to one hour following sunrise.

A minimum of four samplers should be positioned, one on each side of the field. A fifth sampler should be collocated at one position. Since atrazine is extensively used in the area, background samples should collect enough volume to achieve the recommended target 24-hour quantitation limit of 0.51 $\mu g/m^3$. Ideally, samplers should be placed a minimum of 20 meters from the field. Field spike samples should be collected at the same environmental conditions (temperature humidity, exposure to sunlight) and experimental conditions (similar air flow rates) as those occurring at the time of sampling.

Additionally, we request that you provide in the monitoring report: 1) an accurate record of the positions of the monitoring equipment with respect to the field, including the exact distance that the sampler is positioned from the field; 2) an accurate drawing of the monitoring site showing the precise location of the meteorological equipment, trees, buildings, and other obstacles; 3) meteorological data collected at a minimum of 15-minute intervals including wind speed and direction, humidity, and air temperature, and comments regarding degree of cloud cover; and 4) the elevation of each sampling station with respect to the field, and the orientation of the field with respect to North (identified as either true or magnetic North).

D. SAFETY RECOMMENDATIONS

Monitoring personnel should use proper protective equipment to prevent exposure to the vapors or spray mist. According to the product labels, proper protective equipment for applicators includes long-sleeved shirt and long pants, water-resistant gloves, and chemical-resistant footwear plus socks. Additional recommendations include protective eyewear, chemical-resistant headgear for overhead exposure, and a cartridge respirator equipped with a filter cartridge approved for use with pesticides. Monitoring personnel should refer to the label of the actual product used for further precautions.

E. GENERAL REFERENCES

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APPENDIX V

APPLICATION AND AMBIENT FIELD LOG SHEETS

Atrazine Application

SAMPLE FIELD LOG BOOK

Project: Pesticide Air Monitoring

Project #: C99-035a

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
1	NE	6/3/99 6/9/99	1010 1010	3.0	3.00	✓	✓		K	KEM
2	NFS1	6/3/99 6/9/99	1010 1010	3.0	3.04	✓	✓			
3	SE	6/3/99 6/9/99	1030 1030	3.0	3.00	✓	✓			
4	SFS2	6/3/99 6/9/99	1030 1030	3.0	3.08	✓	✓			
5	NE	6/3/99 6/9/99	1040 1040	3.00	3.00	✓	✓			
6	WFS?	6/3/99 6/9/99	1040 1040	3.04	3.00	✓	✓			
7	EB	6/3/99 6/9/99	1045 1045	3.0	2.89	✓				
8	EFS 4	6/3/99 6/9/99	1045 1045	3.0	3.03	✓				
9	TS1	6/9/99	1010	—	—	—	—			
10	TS2	6/9/99	1010	-	-	-	-			
11	TS3	6/9/99	1010	-	-	-	-			
12	TS4	6/9/99	1010	-	-	-	-			
13	S1	6/10/99 6/10/99	0640 0830	3.00	3.00	✓	✓		K	K
14	E1	6/10/99 6/10/99	0645 0835	3.00	3.00	✓	✓			
15	E1D	6/10/99 6/10/99	0645 0835	3.00	3.00	✓	✓			
16	W1	6/10/99 6/10/99	0655 0840	3.00	3.00	✓	✓			
17	N1	6/10/99 6/10/99	0700 0845	3.00	3.00	✓	✓			
18	S2	6/10/99 6/10/99	0830 0930	3.00	3.06	✓	✓			
19	E2	6/10/99 6/10/99	0835 0935	3.00	2.98	✓	✓			
20	E2D	6/10/99 6/10/99	0835 0935	3.00	3.00	✓	✓			
21	W2	6/10/99 6/10/99	0840 0940	3.00	2.96	✓	✓			
22	N2	6/10/99 6/10/99	0845 0945	3.00	3.00	✓	✓			

Atrazine Application

SAMPLE FIELD LOG BOOK

Project: Pesticide Air Monitoring

Project #: C99-035a

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
23	E3	6/10/99	0930	3.00	2.97	✓	✓		K	KEM
		6/10/99	1130							
24	E7	6/10/99	0935	3.00	2.92	✓	✓			
		6/10/99	1135							
25	E3L	6/10/99	0935	3.00	2.93	✓	✓			
		6/10/99	1135							
26	W3	6/10/99	0940	3.00	2.95	✓	✓			
		6/10/99	1140							
27	N3	6/10/99	0945	3.00	2.98	✓	✓			
		6/10/99	1145							
28	E-	6/10/99	1130	3.00	2.86	✓	✓			
		6/10	1530							
29	E-	6/10/99	1135	3.00	2.98	✓	✓			
		6/10	1535							
30	E.L	6/10/99	1135	3.00	2.99	✓	✓			
		6/10	1535							
31	W4	6/10/99	1140	3.00	2.84	✓	✓			
		6/10	1540							
32	N4	6/10/99	1145	3.00	3.00	✓	✓			
		6/10	1545							
33	S5	6/10/99	1530	3.00	3.00	✓	✓			
		6/10	1945							
34	E5	6/10/99	1535	3.00	2.91	✓	✓			
		6/10	1950							
35	E5D	6/10/99	1535	3.00	3.00	✓	✓			
		6/10	1950							
36	W5	6/10/99	1540	3.00	2.05	✓	✓			
		6/10	1955							
37	N5	6/10/99	1545	3.00	3.00	✓	✓			
		6/10	2000							
* 38	S6	6/10/99	1945	3.00		✓		Pump burned up		
		6/11/99	0700							
39	E6	6/10/99	1950	3.00	3.00	✓	✓			
		6/11/99	0730							
40	E6L	6/10/99	1950	3.00	2.96	✓				
		6/11/99	0730							
41	W6	6/10/99	1955	3.00	3.00	✓				
		6/11	1915							
42	N6	6/10/99	2000	3.00	3.00	✓				
		6/11/99	0720							

Atrazine Application

SAMPLE FIELD LOG BOOK

Project: Pesticide Air Monitoring

Project #: C99-035a

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
43	S7	6/11	0700	3.00	3.01	✓	✓		K	KEM
		6/11	1800							
44	E7	6/11	0730	3.00	2.94	✓	✓			
		6/11	1815							
45	E7D	6/11	0730	3.00	3.00	✓	✓			
		6/11	1815							
46	W7	6/11	0715	3.00	2.91	✓	✓			
		6/11	1820							
47	N7	6/11	0720	3.00	2.97	✓	✓			
		6/11	1820							
48	S8	6/11	1820	3.00	3.00	✓	✓			
		6/12	0700							
49	E8	6/12	0715	3.00	2.54	✓	✓			
		6/12	1815							
50	E8D	6/12	0715	3.00	2.80	✓	✓			
		6/12	1815							
51	W8	6/12	0720	3.00	3.00	✓	✓			
		6/12	1820							
52	N8	6/12	0730	3.00	2.95	✓	✓			
		6/12	1825							
53	S9	6/12	0700	3.00	3.03	✓	✓			
		6/13	0700							
54	E9	6/12	0715	3.00	2.92	✓	✓			
		6/13	0715							
55	E9D	6/12	0715	3.00	2.85	✓	✓			
		6/13	0715							
56	W9	6/12	0720	3.00	3.00	✓	✓			
		6/13	0720							
57	N9	6/12	0730	3.00	3.03	✓	✓			
		6/13	0730							
55	TB	6/13	0730	—	—	—	—	Blank		

SAMPLE FIELD LOG BOOK

Project: Atrazine Ambient Air Monitoring

Project #: C99-035

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
1	ARB-1	5/17 5/18	0915 0915	3.0	3.0	[redacted] ✓	✓		K	KEM
2	HER1	5/17 5/18	1000 1000	3.0	2.99	✓	✓			
3	MRE1	5/17 5/18	1016 1016	3.0	2.98	✓	✓			
4	GAL1	5/17 5/18	1035 1035	3.0	3.0	✓	✓			
5	TER1	5/17 5/18	1120 1120	3.0	3.0	✓	✓			
6	ARB2	5/18 5/19	0915 0915	3.0	3.0	✓	✓			NA
7	HER2	5/18 5/19	1000 1000	3.0	2.99	✓	✓			
8	MRE2	5/18 5/19	1016 1016	3.0	2.99	✓	✓			
9	GAL2	5/18 5/19	1035 1035	3.0	3.0	✓	✓			
10	TER2	5/18 5/19	1120 1120	3.0	3.0	✓	✓			
11	ARB3	5/19 5/20	0915 0915	3.0	2.97	✓	✓			
12	ARB3D	5/19 5/20	0915 0915	3.0	3.0	✓	✓			
13	HER3	5/19 5/20	1000 1000	3.0	3.0	✓	✓			
14	HER3D	5/19 5/20	1000 1000	3.0	3.0	✓	✓			
15	MRE3	5/19 5/20	1016 1016	3.0	2.99	✓	✓			
16	MRE3D	5/19 5/20	1016 1016	3.0	3.0	✓	✓			
17	GAL3	5/19 5/20	1035 1035	3.0	3.01	✓	✓			
18	GAL3D	5/19 5/20	1035 1035	3.0	3.0	✓	✓			
19	TER3	5/19 5/20	1120 1120	3.0	2.99	✓	✓			
20	TER3D	5/19 5/20	1120 1120	3.0	2.98	✓	✓			
21	ARB4	5/20 5/21	0915 0915	3.0	2.95					

KEM NA

SAMPLE FIELD LOG BOOK
Project: Atrazine Ambient Air Monitoring
Project #: C99-035

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
22	HER4	5-20 5-21	1000 1000	3.0	2.99	~~✓~~	✓		K	MTh
23	MRE4	5-20 5-21	1016 1016	3.0	2.97	✓	✓			
24	GAL4	5-20 5-21	1035 1035	3.0	3.0	✓	✓			
25	TER4	5-20 5-21	1120 1120	3.0	2.99	✓	✓			
26	ARB5	524 525	0900 0900	3.0	3.0	✓	✓			
27	HER5	5-24 5-25	0945 0945	3.0	2.96	✓	✓			
28	MRE5	5-24 5-25	1000 1000	3.0	2.99	✓	✓			
29	GAL5	5-24 5-25	1020 1020	3.0	3.0	✓	✓			
30	TER5	5-24 5-25	1105 1105	3.0	3.0	✓	✓			
31	ARB6	5-25 5-26	0900 0900	3.0	3.0	✓	✓			
32	HER6	2-25 5-26	0945 0945	3.0	2.99	✓	✓			
33	MRE6	5-25 5-26	1000 1000	3.0	2.97	✓	✓			
34	GAL6	5-25 5-26	1020 1020	3.0	2.98	✓	✓			
35	TER6	5-25 5-26	1105 1105	3.0	3.0	✓	✓			
36	ARB7	5 26 5-27	0900 0900	3.0	2.98	✓	✓			
37	ARB7D	5-26 5-27	0900 0900	~~3.0~~	2.97	✓	✓			
38	BLANK	5-26	0900	3.0		✓		BLANK		
39	HER7	526 527	0945 0945	3.0	3.0	✓	✓			
40	HER7D	5-26 527	0945 0945	3.0	2.98	✓	✓			
41	MRE7	5-26 5-27	1000 1000	3.0	3.0	✓				
42	MRE7D	5-26 5-27	1000 1000	3.0	2.98	✓				

SAMPLE FIELD LOG BOOK
Project: Atrazine Ambient Air Monitoring
Project #: C99-035

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
43	GAL7	5-26 5-27	1020 1020	3.0	3.0	✓	✓		K	NHA
44	GAL7D	5-26 5-27	1020 1020	3.0	2.97	✓	✓			
45	TER7	5-26 5-27	1105 1105	3.0	3.0	✓	✓			
46	TER7D	5-26 5-26	1105 1105	3.0	2.96	✓	✓			
47	ARB8	5-27 5-28	0900 0900	3.0	3.0	✓	✓			
48	HER8	5-27 5-28	0945 0945	3.0	2.97	✓	✓			
49	MRE8	5-27 5-28	1000 1000	3.0	2.98	✓	✓			
50	GAL8	5-27 5-28	1020 1020	3.0	3.0	✓	✓			
51	TER8	5-27 5-28	1105 1105	3.0	2.99	✓	✓			
52	ARB9	6-1 6-2	1015 1015	3.0	3.01	✓	✓		PC	NHA
53	BLANK	6-1	1015	~~3.0~~		✓				
54	AFS528-1	6-1 6-2	1015 1015	3.0	2.99	✓	✓	? Field Spike BACKYARD		
55	AFS528-2	6-1 6-2	1015 1015	3.0	2.97	✓	✓	"		
56	AFS528-3	6-1 6-2	1015 1015	3.0	2.96	✓	✓	"		
57	AFS528-4	6-1 6-2	1015 1015	3.0	2.92	✓	✓	BACKYARD ? ?		
58	HER9	6-1 6-2	1115 1135	3.0	3.0	✓	✓			
59	MRE9	6-1 6-2	1135 1150	3.0	3.0	✓	✓			
60	GAL9	6-1 6-2	1145 1200	3.0	2.98	✓	✓			
61	TER9	6-1 6-2	1215 1855	3.0	2.99	✓	✓			
62	ARB10	6-2 6-2	1015 1015	3.0	3.0	✓	✓			
63	HER10	6-2 6-3	1135 1135	3.0	2.98	✓	✓			

SAMPLE FIELD LOG BOOK
Project: Atrazine Ambient Air Monitoring
Project #: C99-035

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
64	MRE10	6-2 6-3	1150 1150	3.0	3.0	✓	✓		PC	
65	EMU0	6-2 6-3	1200 1200	3.0	2.97	✓	✓			
66	TCR10	6-2 6-3	1255 1255	3.0	2.99	✓	✓			
67	ARB11	6-3 6-4	1015 1015	3.0	3.6	✓	✓			
68	ARB. ID #	6-3 6-4	1015 1015	3.0	2.97	✓	✓			
69	FS-1	6-3 6-4	1015 1015	3.0	2.99	✓	✓	REDO		
70	FS-4	6-3 6-4	1015 1015	3.0	3.0	✓	✓	REDO		
71	HER11	6-3 6-4	1135 1135	3.0	3.0	✓	✓			
72	HER11D	6-3 6-4	1135 1135	3.0	2.97	✓	✓			
73	MRE11	6-3 6-4	1150 1150	3.0	3.0	✓	✓			
74	MRE11D	6-3 6-4	1150 1150	3.0	2.99	✓	✓			
75	GAL11	6-3 6-4	1200 1200	3.0	2.97	✓	✓			
76	GAL11D	6-3 6-4	1200 1200	3.0	2.99	✓	✓			
77	TER11	6-3 6-4	1255 1255	3.0	3.0	✓	✓			
78	TER11D	6-3 6-4	1255 1255	3.0	2.99	✓	✓			
79	TS1							TRIP SPIKES		
80	TS2									
81	TS3									
82	TS4									
83	ARB12	6-7-99 6-8-99	1000 1000	3.0	3.0	✓	✓		K	J.T.
84	HER12	6-7-99 6-8-99	1100 1100	3.0	3.13	✓	✓		K	↓

SAMPLE FIELD LOG BOOK
Project: Atrazine Ambient Air Monitoring
Project #: C99-035

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
85	MRE12	6-7-99	1120	3.0	3.0	✓	✓		K	J.J.
		6-8-99	1120							
86	GAL12	6-7-99	1140	3.0	3.0	✓	✓		K	J.J.
		6-8-99	1140							
87	TER12	6-7-99	1230	3.0	3.0	✓	✓		K	
		6-8-99	1230							
88	BLANK			3.0	—	✓			K	
		6-8-99	1000							
89	ARB13	6-8-99	1000	3.0	2.8	✓	✓	6/9/99 Begin using MFC's 0-20LPM	K	
		6-9-99	1000							
90	HER13	6-8-99	1100	3.0	2.8	✓	✓			
		6-9-99	1100							
91	MRE13	6-8-99	1120	3.0	3.0	✓	✓			
		6-9-99	1120							
92	~~GAL13~~ GAL13	6-8-99	1145	3.0	2.7	✓	✓	GAL13		
		6-9-99	1145							
93	TER13	6-8-99	1235	3.0	2.9	✓	✓		↓	
		6-9-99	1230							
94	ARB14	6-9-99	1000	3.0	2.8	✓	✓		K	
		6-10-99	1000							
95	ARB14D	6-9-99	1000	3.0	2.9	✓	✓		K	
		6-10-99	1000							
96	HER14	6-9-99	1100	3.0	2.5	✓	✓		K	
		6-10-99	1100							
97	HER14D	6-9-99	1100	3.0	2.6	✓	✓		K	
		6-10-99	1100							
98	MRE14	6-9-99	1120	3.0	3.0	✓	✓		K	
		6-10-99	1120							
99	MRE14D	6-9-99	1120	3.0	3.0	✓	✓		K	
		6-10-99	1120							
100	GAL14	6-9-99	1145	3.0	3.0	✓	✓		K	
		6-10-99	1145							
101	GAL14D	6-9-99	1145	3.0	3.0	✓	✓		K	
		6-10-99	1145							
102	TER14	6-9-99	1230	3.0	3.0	✓	✓		K	
		6-10-99	1230							
103	TER14D	6-9-99	1230	3.0	3.0	✓	✓		K	
		6-10-99	1230							
104	ARB15	6-10-99	1000	3.0	3.0	✓	✓		K	
		6-11-99	1000							
105	HER15	6-10-99	1100	3.0	3.0	✓	✓		K	↓
		6-11-99	1100							

SAMPLE FIELD LOG BOOK
Project: Atrazine Ambient Air Monitoring
Project #: C99-035

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
106	MRE15	6-10-99 6-11-99	1120 1120	3.0	3.0	✓	✓		K	J.J.
107	GAL15	6-10-99 6-11-99	1145 1145	3.0	3.0	✓	✓		K	J.J.
108	TER15	6-10-99 6-11-99	1230 1130	3.0	3.0	✓	✓		K	J.J.
109	ARB16	6-14-99 6-15-99	1000 1000	3.6	3.0	✓	✓		K	MA
110	HER16	6-14-99 6-15-99	1050 1050	3.0	299	✓	✓		NT#	
111	MRE16	6-14-99 6-15-99	1100 1100	3.0	297	✓	✓			
112	GAL16	6-14-99 6-15-99	1115 1115	3.0	3.0	✓	✓			
113	TER16	6-14-99 6-15-99	1230 1230	3.0	3.0	✓	✓			
114	ARB17	6-15-99 6-16-99	1000 1000	3.0	299	✓	✓			
115	HER17	6-15-99 6-16-99	1050 1050	3.0	297	✓	✓			
116	MRE17	6-15-99 6-16-99	1100 1100	3.0	3.01	✓	✓			
117	GAL17	6-15-99 6-16-99	1115 1115	3.0	3.00	✓	✓			
118	TER17	6-15-99 6-16-99	1230 1230	3.0	3.0	✓	✓			
119	ARB18	6-16-99 6-17-99	1000 1000	3.0	2.96	✓	✓			
120	ARB18D	6-16-99 6-17-99	1000 1000	3.0	3.0	✓	✓			
121	HER18	6-16-99 6-17-99	1050 1050	3.0	2.98	✓	✓			
122	HER18D	6-16-99 6-17-99	1050 1050	3.0	3.0	✓	✓			
123	MRE18	6-16-99 6-17-99	1100 1100	3.0	3.0	✓	✓			
124	MRE18D	6-16-99 6-17-99	1100 1100	3.0	2.98	✓	✓			
125	GAL18	6-16-99 6-17-99	1115 1115	3.0	3.0	✓	✓			
126	GAL18D	6-16-99 6-17-99	1115 1115	3.0	3.01	✓	✓			

SAMPLE FIELD LOG BOOK
Project: Atrazine Ambient Air Monitoring
Project #: C99-035

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow 3.0	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
127	TER18	6-16-99 6-17-99	1230 1230	3.0	~~3.04~~	✓	✓			
128	TER18D	6-16-99 6-17-99	1230 1230	3.0	2.98	✓	✓			
129	BLANK	6-16-99		—		—				
130	ARB19	6-17-99 6-	1000	3.0	2.97	✓	✓			
131	HER19	6-17-99	1050	3.0	2.99	✓	✓			
132	MRE19	6-17-99	1100	3.0	3.0	✓	✓			
133	GAL19	6-17-99	1115	3.0	3.01	✓	✓			
134	TER19	6-17-99	1230	3.0	3.0	✓	✓			
135	ARB20	6-21-99 6-22-99	1000 1000	3.0	2.97	✓	✓			
136	HER20	6-21-99 6-22-99	1050 1050	3.0	3.03	✓	✓			
137	MRE20	6-21-99 6-22-99	1100 1100	3.0	2.99	✓	✓			
138	GAL20	6-21-99 6-22-99	1115 1115	3.0	3.0	✓	✓			
139	TER20	6-21-99 6-22-99	1230 1230	3.0	2.96	✓	✓			
140	ARB21	6-22-99 6-23-99	1000 1000	3.0	2.98	✓	✓			
141	HER21	6-22-99 6-23-99	1050 1050	3.0	3.0	✓	✓			
142	MRE21	6-22-99 6-23-99	1100 1100	3.0	3.0	✓	✓			
143	GAL21	6-22-99 6-23-99	1115 1115	3.0	2.98	✓	✓			
140	TER21	6-22-99 6-23-99	1230 1230	3.0	3.0	✓	✓			
145	ARB22	6-23-99 6-24-99	1000 1000	3.0	3.0	✓	✓			
146	ARB22D	6-23-99 6-24-99	1000 1000	3.0	2.96	✓	✓			
147	BLANK	6-23-99 ~~6-24-99~~	1000 KG							

SAMPLE FIELD LOG BOOK
Project: Atrazine Ambient Air Monitoring
Project #: C99-035

Log #	Sample ID	Date On/Off	Time On/Off	Start Flow	End Flow	Start Leak Check	End Leak Check	Comments	Weather o=overcast pc=partly c=cloudy k=clear	Techn. Initial
148	HERC1	6-23-99 / 6-24-99	1050 / 1050	3.0	3.0	✓			K	
149	HER23D	6-23-99 / 6-24-99	1050 / 1050	3.0	3.02	✓				
150	MREC2	6-23-99 / 6-24-99	1100 / 1100	3.0	2.99	✓	✓			
151	MREC2D	6-23-99 / 6-24-99	1100 / 1100	3.0	2.96	✓	✓			
152	GHLC2	6-23-99 / 6-24-99	1115 / 1115	3.0	3.0	✓	✓			
153	GHLC2D	6-23-99 / 6-24-99	1115 / 1115	3.0	3.0	✓	✓			
154	TERC2	6-23-99 / 6-24-99	1230 / 1230	3.0	3.01	✓	✓			
155	TER2D	6-23-99 / 6-24-99	1230 / 1230	3.0	3.0	✓	✓			
156	ARB23	6-24-99 / 6-25-99	1000 / 1000	3.0	3.0	✓	✓			
157	HER23	6-24-99 / 6-25-99	1050 / 1050	3.0	3.0	✓	✓			
158	MREC23	6-24-99 / 6-25-99	1100 / 1100	3.0	2.99	✓	✓			
159	GHLC23	6-24-99 / 6-25-99	1115 / 1115	3.0	2.98	✓	✓			
160	TERC23	6-24-99 / 6-25-99	1230 / 1230	3.0	3.0	✓	✓			
161	ARB24	6-28-99 / 6-29-99	1000 / 1000	3.0	3.0	✓	✓			
162	HERC4	6-28-99 / 6-29-99	1100 / 1040	3.0	2.99	✓	✓			
163	MREC4	6-28-99 / 6-29-99	1115 / 1100	3.0	2.97	✓	✓			
164	GALC4	6-28-99 / 6-29-99	1130 / 1120	3.0	3.0	✓	✓			
165	TERC4	6-28-99 / 6-29-99	1250 / 1250	3.0	2.98	✓	✓			
166	BLANK									

APPENDIX VI

ATRAZINE APPLICATION METEOROLOGICAL DATA

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/8/99	11:15	3.1	348.3	69	39.6	29.97	26.1
6/8/99	11:30	9.2	238.7	68.2	40.4	30	48.1
6/8/99	11:45	7.6	276.8	68.1	37.9	30.01	35.9
6/8/99	12:00	7.3	308.4	68.5	35.8	30.01	38.4
6/8/99	12:15	8	289	68.5	34.2	30.01	27
6/8/99	12:30	7.3	279	69.6	34	30.01	32.7
6/8/99	12:45	8.7	281.4	69.8	34.2	30.01	13.9
6/8/99	13:00	8.3	276.2	70.9	33.8	30.01	20.8
6/8/99	13:15	9.9	286.3	71.1	32.8	30.01	25.6
6/8/99	13:30	7.9	264.6	71.9	31.3	30	22.9
6/8/99	13:45	9.7	274.5	72.5	28.9	30	19.2
6/8/99	14:00	10	279.1	72.6	27.5	29.99	16.3
6/8/99	14:15	7.2	293	73.4	29.1	29.98	28.9
6/8/99	14:30	10.8	289.9	73.5	28.5	29.98	15
6/8/99	14:45	9.1	292.2	73.4	27.3	29.97	30.2
6/8/99	15:00	9.5	290.9	74.8	27.1	29.97	15.3
6/8/99	15:15	9.7	284.7	74.8	25.9	29.96	23.4
6/8/99	15:30	10	303.4	74.9	24.7	29.96	16.6
6/8/99	15:45	8.9	286.1	75	22.4	29.96	18
6/8/99	16:00	8.4	275.5	75.7	20.4	29.96	18.9
6/8/99	16:15	8.7	298.8	76	21.4	29.95	20.2
6/8/99	16:30	7.4	291.4	76.6	20.6	29.95	21
6/8/99	16:45	9.5	278.8	76.5	20.3	29.94	24.7
6/8/99	17:00	10.5	280.7	76.6	19.4	29.94	19.7
6/8/99	17:15	8.7	284.6	76.8	19.7	29.94	18.5
6/8/99	17:30	10	286.3	76.9	18.6	29.93	19.5
6/8/99	17:45	10.2	301.9	76.7	18.7	29.93	11.4
6/8/99	18:00	10	293	76.8	20.1	29.93	12.8
6/8/99	18:15	9.6	271.3	76.7	20.9	29.93	20.4
6/8/99	18:30	10.5	260	76.2	24.2	29.92	17.6
6/8/99	18:45	14.4	249.3	75.4	27	29.92	14.6
6/8/99	19:00	16.6	247.7	73.5	30.3	29.92	6.1
6/8/99	19:15	17	250.8	72.5	31.8	29.92	7.1
6/8/99	19:30	15.6	251.7	71.4	32.3	29.92	6.4
6/8/99	19:45	13.7	246	70.3	33.1	29.92	6.6
6/8/99	20:00	14.2	246	69	34.1	29.91	5.4
6/8/99	20:15	12.7	245.9	67.5	35.8	29.91	5.3
6/8/99	20:30	9.8	235.5	65.9	38.5	29.91	6
6/8/99	20:45	8.5	233.5	64.4	40.5	29.9	5.7
6/8/99	21:00	9.8	244.2	63.5	40.6	29.9	5.7
6/8/99	21:15	9.3	237.9	62.5	41.6	29.9	4.7
6/8/99	21:30	9.4	234.8	62	40.6	29.9	6
6/8/99	21:45	8.8	240.3	61.1	42.4	29.89	5.8
6/8/99	22:00	8.6	237.1	60.1	44.7	29.89	4.8
6/8/99	22:15	7.2	230.8	59.3	46.9	29.89	5.1

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/8/99	22:30	8.4	235.3	58.7	49.1	29.88	4.7
6/8/99	22:45	8	229.1	57.8	52.6	29.88	4.2
6/8/99	23:00	8.1	223.8	57	56.2	29.87	5.9
6/8/99	23:15	8.8	231.2	56.7	56.9	29.87	5.9
6/8/99	23:30	7.8	239.5	56	58.1	29.87	4.5
6/8/99	23:45	6	236	55.5	58.6	29.87	16.8
6/8/99	24:00:00	4	86.9	54.9	58.5	29.87	62.3
6/9/99	0:15	3.5	100.5	54.9	57.6	29.87	45.8
6/9/99	0:30	2.5	161.1	55.1	57.3	29.87	26
6/9/99	0:45	2.6	173.8	54.9	57.1	29.87	22.4
6/9/99	1:00	2.1	188.6	54.6	57.4	29.86	32
6/9/99	1:15	2.3	134.6	54.1	58.2	29.86	11.8
6/9/99	1:30	3.8	126.4	53.4	60	29.85	7.6
6/9/99	1:45	4.3	134.9	52.2	61.7	29.85	15.6
6/9/99	2:00	3.5	149.6	53	60.1	29.85	8.7
6/9/99	2:15	3.8	162.3	52.8	60.6	29.84	6.1
6/9/99	2:30	4.7	157.9	51.6	63.4	29.84	7.6
6/9/99	2:45	3.7	196.5	52.7	63.5	29.84	9.8
6/9/99	3:00	3.7	217.1	52.7	64.7	29.83	11.6
6/9/99	3:15	3.7	221.5	52.2	66.2	29.83	10.5
6/9/99	3:30	4.8	259.5	52.5	65.4	29.83	18
6/9/99	3:45	4.8	289.5	52.6	65.4	29.83	4.7
6/9/99	4:00	3.3	266	51.7	68	29.83	23.6
6/9/99	4:15	3.8	241.8	50.7	68.8	29.83	15.1
6/9/99	4:30	2.1	264.6	50.6	69.2	29.83	14.1
6/9/99	4:45	0.9	176.8	49	72.8	29.83	64.2
6/9/99	5:00	2.5	57.6	49.4	71.7	29.83	9.4
6/9/99	5:15	2.8	84.8	49.6	72.1	29.83	4.6
6/9/99	5:30	3.5	130.2	48.6	72.8	29.83	25.6
6/9/99	5:45	4.1	152.7	47.6	73.9	29.83	7.7
6/9/99	6:00	3.7	142.7	47.8	72	29.83	9.8
6/9/99	6:15	4.5	120.1	48.8	70.9	29.83	8.2
6/9/99	6:30	5.2	108.5	49.9	69.5	29.84	5.6
6/9/99	6:45	4.7	121.9	50.8	68.2	29.85	9.6
6/9/99	7:00	3.7	143.7	53	63.8	29.85	16.3
6/9/99	7:15	3.6	173.8	54.4	61.7	29.86	30.4
6/9/99	7:30	5.8	217	54.4	63	29.87	9.2
6/9/99	7:45	6.6	222.3	54.9	62.8	29.88	12.8
6/9/99	8:00	8.8	232.3	55.6	62.3	29.89	11.6
6/9/99	8:15	9.8	241.1	56.7	61	29.9	9.5
6/9/99	8:30	8.7	238.4	57.8	59.4	29.91	11.5
6/9/99	8:45	8	247.6	59	57.6	29.91	12.7
6/9/99	9:00	6.8	237	60.1	56.3	29.92	19.4
6/9/99	9:15	6.7	245	61.2	54.3	29.93	23.2
6/9/99	9:30	5.2	228.1	62.5	52.6	29.94	23.7

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/9/99	9:45	5.1	251.4	64.3	49.9	29.94	26.3
6/9/99	10:00	4.7	249.7	65.9	47.4	29.94	47.4
6/9/99	10:15	4.5	280	67.1	45	29.94	35.9
6/9/99	10:30	3.8	296.7	68.7	43.4	29.95	39.8
6/9/99	10:45	5.7	302.6	69.1	43.3	29.95	26.6
6/9/99	11:00	3.9	235.5	70.3	39.2	29.95	25.3
6/9/99	11:15	6.2	287.9	70.7	39.7	29.96	23.6
6/9/99	11:30	4.9	293.1	71.5	39.6	29.97	27
6/9/99	11:45	5.2	275.4	72.8	39	29.97	37.4
6/9/99	12:00	5.7	269	73.8	38.6	29.97	35
6/9/99	12:15	7.6	288.3	74.3	36.4	29.97	32.5
6/9/99	12:30	6.8	284.4	74.4	34.7	29.97	38.6
6/9/99	12:45	5.8	261	75.8	32.4	29.96	49
6/9/99	13:00	7.7	256.6	75.7	32.1	29.96	27.5
6/9/99	13:15	8.4	278.5	76.5	31.1	29.96	21.2
6/9/99	13:30	8.7	269.9	76.7	30	29.96	25.5
6/9/99	13:45	8.2	252.1	77.2	28.9	29.96	16.4
6/9/99	14:00	7.8	281	77.8	26.7	29.95	21.7
6/9/99	14:15	8.6	271.8	78.6	24.5	29.95	20.8
6/9/99	14:30	7.8	259.2	78.8	26	29.94	44.4
6/9/99	14:45	9.7	269	78.8	25	29.94	22.4
6/9/99	15:00	10.2	242.3	78.6	23.8	29.94	14.5
6/9/99	15:15	9.8	271.2	79.2	23.4	29.94	29
6/9/99	15:30	8.3	275.9	79.4	23.8	29.94	34.7
6/9/99	15:45	6.9	270	80.4	23.3	29.93	31.9
6/9/99	16:00	8.9	260.9	80.3	24.5	29.93	35
6/9/99	16:15	10.5	254.8	79.5	23.9	29.92	18.4
6/9/99	16:30	11.8	277.6	80	22.2	29.92	31.9
6/9/99	16:45	12.7	240.6	79.3	20.4	29.91	13.3
6/9/99	17:00	14	245.6	79.4	20.1	29.91	13.3
6/9/99	17:15	13.2	245.8	79.2	19.5	29.91	14.5
6/9/99	17:30	11.9	246.3	78.9	19	29.9	10
6/9/99	17:45	11.8	245	78.7	18.5	29.9	9.6
6/9/99	18:00	13.5	247.6	78.4	19.1	29.9	9.1
6/9/99	18:15	15.5	232.4	78.3	21.4	29.89	9.2
6/9/99	18:30	17.6	238.8	77.5	23.7	29.89	6.5
6/9/99	18:45	18.7	237	76.4	24.2	29.89	5.7
6/9/99	19:00	17.5	238.4	75.5	24.3	29.89	5.8
6/9/99	19:15	17.4	238.5	74.4	28	29.89	5.4
6/9/99	19:30	17.1	239	73.3	32	29.89	5.5
6/9/99	19:45	14.9	240.3	72.2	36.6	29.88	5.6
6/9/99	20:00	15.2	241.3	70.6	40.1	29.88	6.4
6/9/99	20:15	15.3	246	68.8	40.7	29.88	6.1
6/9/99	20:30	12.1	240.8	67.2	41	29.88	5.5
6/9/99	20:45	10.8	236.8	65.9	42.2	29.88	5.7

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/9/99	21:00	11.3	236.3	65	43.8	29.87	6.2
6/9/99	21:15	12.7	237.4	64.2	46	29.87	5.3
6/9/99	21:30	9.8	228.6	63.1	48.5	29.87	8.9
6/9/99	21:45	9.6	224.5	62	51.7	29.87	6.2
6/9/99	22:00	8.3	229.2	61.2	53.8	29.87	5.2
6/9/99	22:15	8.8	233.3	60.6	54.3	29.87	5.3
6/9/99	22:30	7.4	228.3	59.7	55.2	29.87	5.2
6/9/99	22:45	6.2	234.4	58.9	55.9	29.88	6
6/9/99	23:00	3.2	189.3	58.3	56.2	29.88	47
6/9/99	23:15	3.2	204.3	58	55.1	29.88	45.5
6/9/99	23:30	3.4	93	58	54	29.89	30.4
6/9/99	23:45	2.2	92.2	57.1	54.7	29.88	52.3
6/9/99	24:00:00	2.2	174.7	57.3	54.2	29.88	49.4
6/10/99	0:15	3.2	192.2	57.5	54.1	29.87	34.2
6/10/99	0:30	3.5	207.2	57	55	29.87	21.7
6/10/99	0:45	3.8	211.6	56.9	54.9	29.87	14.5
6/10/99	1:00	4.1	210.2	56	57.1	29.87	18.8
6/10/99	1:15	3.3	145.5	55.8	56.9	29.87	21.9
6/10/99	1:30	2.7	138.6	55	59.1	29.86	16.8
6/10/99	1:45	2.8	202.4	54.9	59.3	29.86	33.5
6/10/99	2:00	2.1	206.5	55.1	59	29.86	18.3
6/10/99	2:15	1.1	235.1	54.6	59.1	29.86	45.6
6/10/99	2:30	2.4	271.4	54.7	59.1	29.85	15.3
6/10/99	2:45	2.4	284.8	54.9	59.3	29.85	11.5
6/10/99	3:00	2.6	294.2	54.4	60.7	29.85	9.6
6/10/99	3:15	2.5	302.9	53.9	62.7	29.85	9.9
6/10/99	3:30	2.5	284.3	53.5	63.4	29.85	5.6
6/10/99	3:45	2.7	271.4	52.9	65.1	29.84	5.1
6/10/99	4:00	2.7	250.7	52.8	65.4	29.84	16
6/10/99	4:15	1.8	192.2	52	66.9	29.84	10.2
6/10/99	4:30	3.3	172.4	51.3	68	29.84	7.3
6/10/99	4:45	4.5	161.3	51.4	66.5	29.84	18.1
6/10/99	5:00	4.4	261.2	52.8	63.9	29.84	23.2
6/10/99	5:15	5.6	270.9	53	64.3	29.84	9.6
6/10/99	5:30	5.7	264.1	52.2	66.5	29.85	5
6/10/99	5:45	6.1	256.5	51.5	68.7	29.85	4.9
6/10/99	6:00	6.4	247.1	51.3	69.8	29.86	5.6
6/10/99	6:15	6.3	246.7	51.9	69	29.86	6.4
6/10/99	6:30	5.7	243.8	52.5	68.5	29.86	6.5
6/10/99	6:45	5.5	233.8	53.2	67.3	29.87	6.8
6/10/99	7:00	5.8	227.8	54	65.6	29.88	7.4
6/10/99	7:15	6.4	227.8	54.7	64.4	29.89	8.7
6/10/99	7:30	7.9	234.6	55.1	64.2	29.89	11.1
6/10/99	7:45	8.2	244.9	55.7	64.2	29.9	12.2
6/10/99	8:00	8.5	247.1	56.7	63.5	29.91	11.2

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/10/99	8:15	8.3	238.4	57.4	62.7	29.93	11.8
6/10/99	8:30	8.4	245.3	58.3	61.8	29.93	11.9
6/10/99	8:45	7.7	253.1	59.3	60.8	29.94	12.2
6/10/99	9:00	7.1	266.5	60.9	58	29.94	14.9
6/10/99	9:15	7.5	259.5	61.9	56	29.95	16.1
6/10/99	9:30	7.1	276.9	63.1	54.7	29.95	15.7
6/10/99	9:45	6.4	286.8	64.2	53.6	29.96	16.9
6/10/99	10:00	6.1	295.4	65.2	52.7	29.96	16
6/10/99	10:15	6.1	299.3	66.4	51	29.96	24.8
6/10/99	10:30	7.8	290.7	67.3	49.1	29.96	15.7
6/10/99	10:45	8.2	286	68.8	47.2	29.96	15.3
6/10/99	11:00	6.8	279	70	45.8	29.97	25.7
6/10/99	11:15	6.9	293.5	71.1	42.2	29.97	18.5
6/10/99	11:30	7.1	298.3	72.4	39.8	29.97	26.6
6/10/99	11:45	7.2	275.8	73	36.9	29.97	18.3
6/10/99	12:00	7.5	283.2	74.5	34.4	29.97	18.1
6/10/99	12:15	8.4	277.2	74.9	33.3	29.97	20.5
6/10/99	12:30	7.7	278.2	76.2	31.6	29.97	18.5
6/10/99	12:45	7.4	279.7	76.9	29.7	29.97	21.4
6/10/99	13:00	8.4	267.8	77.5	29.1	29.97	14.3
6/10/99	13:15	8	276.9	78.4	28	29.97	27.2
6/10/99	13:30	8.2	282.8	79.1	26.7	29.97	24.6
6/10/99	13:45	6.8	284.7	79.7	27	29.97	24.9
6/10/99	14:00	8.7	302.4	80.5	23.3	29.96	16.8
6/10/99	14:15	9.1	295.3	80.6	22.9	29.96	21.1
6/10/99	14:30	8.3	293.9	81.5	21.4	29.96	24.7
6/10/99	14:45	9.5	290	81.8	23.1	29.95	26.4
6/10/99	15:00	6.6	271.9	82	22.4	29.95	28.8
6/10/99	15:15	8.1	281.9	82.9	22.3	29.94	22.9
6/10/99	15:30	7.1	310	83.8	21.1	29.94	38.8
6/10/99	15:45	9.3	246.9	83.1	22.3	29.93	20.5
6/10/99	16:00	10.7	263.7	83.2	22.1	29.93	18
6/10/99	16:15	9.5	260.9	83.6	22.2	29.93	18.1
6/10/99	16:30	9.6	280.1	83.7	22.3	29.92	18.4
6/10/99	16:45	9.8	268.5	84.1	22.5	29.92	18.5
6/10/99	17:00	13.3	247.6	83.1	24.5	29.91	17
6/10/99	17:15	13	255.1	83.5	24	29.91	19.5
6/10/99	17:30	14.4	255.3	83.1	24.2	29.91	10.5
6/10/99	17:45	13.9	246.1	82.5	24.5	29.9	11.7
6/10/99	18:00	16.7	249.4	82	26.6	29.9	10.3
6/10/99	18:15	16.5	250.1	81.4	27.5	29.9	8.3
6/10/99	18:30	18.1	250.3	80.5	29	29.89	6.4
6/10/99	18:45	18.3	253.4	79.5	31.6	29.89	5.5
6/10/99	19:00	17.7	248.1	78.8	32.2	29.89	6.3
6/10/99	19:15	17.4	249.6	78.2	32.3	29.89	6.9

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/10/99	19:30	15.4	246.7	77.5	33	29.89	7.4
6/10/99	19:45	15.6	241.9	76.5	32.6	29.88	6.9
6/10/99	20:00	13.7	245.7	75.5	33.4	29.88	6.4
6/10/99	20:15	12.3	247.5	74.2	34.8	29.88	5.5
6/10/99	20:30	12.1	241.8	73	37.4	29.88	5.9
6/10/99	20:45	9.6	235.7	71.7	39.7	29.88	6.4
6/10/99	21:00	10.3	235.5	70.7	41.3	29.87	4.6
6/10/99	21:15	9	226.8	69.8	40.8	29.87	5.3
6/10/99	21:30	8.6	229.7	69.1	40.1	29.87	4.7
6/10/99	21:45	8.7	236	68.3	41.3	29.87	5.3
6/10/99	22:00	7.7	243.7	67.3	43.9	29.87	4.9
6/10/99	22:15	6.7	245.6	66.3	45.6	29.87	5.5
6/10/99	22:30	7.3	242.7	65.7	46.2	29.87	5.1
6/10/99	22:45	8.1	240.7	65.3	46.1	29.87	7.2
6/10/99	23:00	6.8	230.2	64.7	46.4	29.87	9.8
6/10/99	23:15	6.8	231	64.2	47.1	29.86	5.8
6/10/99	23:30	5.9	225.8	63.7	47.1	29.86	10.9
6/10/99	23:45	4.1	122.7	63	47.3	29.86	47.8
6/10/99	24:00:00	3.7	120	63.2	46.1	29.86	33.6
6/11/99	0:15	3.6	132.5	63.2	45.8	29.86	38.9
6/11/99	0:30	3.4	122.3	62.9	46.2	29.86	27.6
6/11/99	0:45	3.7	134.6	62.1	47.7	29.86	25.3
6/11/99	1:00	3.6	153.8	61.9	48	29.85	16.8
6/11/99	1:15	4.3	108.6	61	50	29.85	12.2
6/11/99	1:30	3	148	61.5	48.8	29.85	28.5
6/11/99	1:45	3.2	127.2	60.7	50.7	29.85	19.8
6/11/99	2:00	2.4	162.9	59.7	53	29.85	24.5
6/11/99	2:15	3.7	181.8	60	52.7	29.84	19.4
6/11/99	2:30	3.7	234.5	60.5	51.8	29.84	29.3
6/11/99	2:45	2.7	187.6	59.9	53.6	29.84	12
6/11/99	3:00	2.6	185.8	59.4	53.9	29.84	24.2
6/11/99	3:15	3.4	205.1	59.9	53	29.84	15.1
6/11/99	3:30	3.9	216.1	59.6	53.1	29.84	15.6
6/11/99	3:45	6.1	226.1	59.2	53.4	29.84	9.5
6/11/99	4:00	5.6	221.6	58.6	55.1	29.84	3
6/11/99	4:15	6.9	227.9	58.4	54.7	29.84	9.1
6/11/99	4:30	6.6	231.4	58	55.2	29.83	7.8
6/11/99	4:45	4	210.2	57	57.8	29.84	15.4
6/11/99	5:00	2.9	205.9	56.7	57.9	29.84	28.1
6/11/99	5:15	3.1	158.9	56.8	57.9	29.84	20.6
6/11/99	5:30	3.8	121.5	55.5	59.4	29.84	4.1
6/11/99	5:45	5.4	197.1	56	57.9	29.84	31.3
6/11/99	6:00	4.8	205.2	56.4	57.2	29.84	11.1
6/11/99	6:15	2.9	136.6	56.7	56.6	29.85	27.2
6/11/99	6:30	1.8	132.9	57.4	55.7	29.85	27.9

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/11/99	6:45	1.7	202.9	58.6	53.5	29.86	20.9
6/11/99	7:00	2.7	174.6	59.4	53.5	29.87	16.4
6/11/99	7:15	5.3	192.4	60	52.7	29.88	12.8
6/11/99	7:30	8.1	213.7	60.3	50.5	29.89	9.6
6/11/99	7:45	9.1	225.8	60.5	50.3	29.9	9.5
6/11/99	8:00	9	202.5	65.9	45	29.906	None
6/11/99	8:30	9	225	68.3	44	29.909	None
6/11/99	9:00	6	225	72.8	41	29.904	None
6/11/99	9:30	5	202.5	76.1	38	29.894	None
6/11/99	10:00	7	202.5	76.5	37	29.892	None
6/11/99	10:30	9	225	77.4	37	29.894	None
6/11/99	11:00	9	225	79.5	37	29.892	None
6/11/99	11:30	9	225	82.3	37	29.89	None
6/11/99	12:00	10	225	83.4	36	29.886	None
6/11/99	12:30	11	225	82.3	34	29.879	None
6/11/99	13:00	12	247.5	82.8	33	29.878	None
6/11/99	13:30	10	225	83.5	33	29.869	None
6/11/99	14:00	12	225	86.6	31	29.865	None
6/11/99	14:30	14	225	86.2	30	29.862	None
6/11/99	15:00	15	225	85.8	30	29.855	None
6/11/99	15:30	14	225	85.6	28	29.848	None
6/11/99	16:00	15	225	85.4	28	29.844	None
6/11/99	16:30	15	225	85.2	30	29.841	None
6/11/99	17:00	17	225	84.7	30	29.841	None
6/11/99	17:30	19	225	82.7	33	29.846	None
6/11/99	18:00	18	225	80.2	35	29.849	None
6/11/99	18:30	18	225	77.9	37	29.853	None
6/11/99	19:00	18	225	75.7	38	29.863	None
6/11/99	19:30	17	225	72.7	40	29.871	None
6/11/99	20:00	19	225	69.7	43	29.882	None
6/11/99	20:30	15	225	66.6	48	29.896	None
6/11/99	21:00	12	225	64.3	52	29.91	None
6/11/99	21:30	10	202.5	62.9	55	29.928	None
6/11/99	22:00	7	202.5	61.9	57	29.942	None
6/11/99	22:30	4	135	60.5	62	29.947	None
6/11/99	23:00	4	135	59	64	29.952	None
6/11/99	23:30	5	135	57.9	66	29.958	None
6/11/99	24:00:00	4	157.5	57.3	67	29.959	None
6/12/99	0:30	3	157.5	56.6	68	29.956	None
6/12/99	1:00	3	180	55.6	71	29.962	None
6/12/99	1:30	3	135	55.2	73	29.967	None
6/12/99	2:00	3	180	54.5	76	29.964	None
6/12/99	2:30	3	157.5	53.8	78	29.966	None
6/12/99	3:00	3	157.5	53.6	79	29.97	None
6/12/99	3:30	3	157.5	53.8	80	29.967	None

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/12/99	4:00	2	135	52.8	81	29.971	None
6/12/99	4:30	2	112.5	52.8	83	29.97	None
6/12/99	5:00	2	112.5	52.2	84	29.974	None
6/12/99	5:30	4	112.5	51	83	29.984	None
6/12/99	6:00	4	112.5	51.6	84	29.993	None
6/12/99	6:30	4	90	53.8	83	29.995	None
6/12/99	7:00	4	135	56.6	81	30	None
6/12/99	7:30	3	135	59	74	30.008	None
6/12/99	8:00	1077	220.2	60.5	55.1	29.94	17.5
6/12/99	8:15	4.6	219.4	59.2	63.4	30	21.5
6/12/99	8:30	5	221.3	59.1	64	30.01	16
6/12/99	8:45	6.2	216.5	59.8	63.1	30.01	19.2
6/12/99	9:00	4.6	222	61.2	60.9	30.02	26.4
6/12/99	9:15	3.8	211.2	63	58.5	30.02	31.4
6/12/99	9:30	4.4	208.9	63.5	57.7	30.04	26.9
6/12/99	9:45	5.6	202.6	65	55.2	30.04	36.6
6/12/99	10:00	5.4	198.2	66.2	52.7	30.05	24.8
6/12/99	10:15	4	177.4	67.9	50.8	30.05	34.7
6/12/99	10:30	4.9	213	69.1	48.6	30.05	41
6/12/99	10:45	5.1	210.8	70.2	46.1	30.06	17.8
6/12/99	11:00	4.8	240.4	71.6	44.4	30.06	35.3
6/12/99	11:15	4.3	217	73.1	41.5	30.06	28.3
6/12/99	11:30	5.6	212.8	73.7	41.7	30.07	22.5
6/12/99	11:45	6.8	206.6	74.1	40.2	30.07	17.4
6/12/99	12:00	7.4	218.9	75.2	38.6	30.07	23.9
6/12/99	12:15	7	221.9	76	37.3	30.08	14.2
6/12/99	12:30	7.8	240.9	76.8	36.7	30.08	16.1
6/12/99	12:45	6.1	224.5	78.2	33.8	30.07	28.5
6/12/99	13:00	7.6	257.3	78.9	33.6	30.07	24.8
6/12/99	13:15	7.2	253.4	79.4	34	30.06	19.3
6/12/99	13:30	6.9	230.7	79.9	32.9	30.07	22.4
6/12/99	13:45	8.5	223.8	80.5	32.1	30.06	19.5
6/12/99	14:00	9.1	229.2	80.5	31.9	30.06	20.7
6/12/99	14:15	9.5	224.2	80.5	30.8	30.06	16.9
6/12/99	14:30	9.1	229.6	81.4	29.6	30.05	20.1
6/12/99	14:45	11.3	243.3	82	26.9	30.05	14.3
6/12/99	15:00	12.5	247.5	81.7	26.2	30.05	13.3
6/12/99	15:15	11.8	240.4	82.2	25.5	30.05	14.2
6/12/99	15:30	12	247.3	82.9	25.1	30.04	17
6/12/99	15:45	13.6	232.6	83	24.8	30.04	12.5
6/12/99	16:00	15.2	234.8	83	22.9	30.04	10.6
6/12/99	16:15	15.9	240	82.8	23.4	30.04	7.7
6/12/99	16:30	16	242.7	82.5	23.4	30.04	8.8
6/12/99	16:45	15.9	243.5	82.7	23.3	30.03	10.8
6/12/99	17:00	19.5	256.2	82.4	23.3	30.03	7.1

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/12/99	17:15	19.6	250.1	81.3	27.9	30.03	8.5
6/12/99	17:30	19.2	249.2	80.2	31.2	30.03	10.7
6/12/99	17:45	19.6	243.2	79.3	34.7	30.02	9.3
6/12/99	18:00	20.3	241.8	78	35.9	30.02	6.7
6/12/99	18:15	20.1	241.1	77	37.7	30.02	6.4
6/12/99	18:30	19	239.6	76.2	38.3	30.02	5.7
6/12/99	18:45	19	238.4	75.6	37.8	30.02	5.3
6/12/99	19:00	19.9	236.6	74.7	36.6	30.02	6.7
6/12/99	19:15	19.2	235.9	74	36.2	30.02	6.4
6/12/99	19:30	19	238.1	72.8	37.7	30.02	6
6/12/99	19:45	15.8	235.9	71.9	41.5	30.02	8.6
6/12/99	20:00	14.8	230.3	70.5	46.3	30.03	7.6
6/12/99	20:15	14.7	224.6	69	48.9	30.02	5.9
6/12/99	20:30	16.3	232.9	67.4	49.9	30.02	5
6/12/99	20:45	14.3	223.9	66.2	52.4	30.02	6
6/12/99	21:00	15.8	228.9	65.3	54.3	30.02	5.3
6/12/99	21:15	16.6	231.9	64.9	55.2	30.02	5.4
6/12/99	21:30	17	233.7	64.4	55.7	30.02	6.3
6/12/99	21:45	18.1	235.9	63.8	55.6	30.02	6.4
6/12/99	22:00	16.9	229.9	62.8	58.5	30.02	6.3
6/12/99	22:15	15.3	228.7	62.2	60.1	30.02	6.4
6/12/99	22:30	12.3	224.6	61.6	61	30.02	12
6/12/99	22:45	5.8	216.2	61.1	62.2	30.03	15.9
6/12/99	23:00	3.4	171.2	60.4	63.8	30.03	22.9
6/12/99	23:15	4.5	181.6	60.1	64	30.03	15.8
6/12/99	23:30	5.8	199.9	59.9	64.5	30.03	12.1
6/12/99	23:45	4.7	194.3	59.5	65.5	30.03	8
6/12/99	24:00:00	4.1	174.6	58.9	66.7	30.02	14.8
6/13/99	0:15	3.6	136.8	58.2	67.9	30.02	9.4
6/13/99	0:30	3.7	146.3	57.8	68.9	30.02	18.8
6/13/99	0:45	4.6	170.6	57.9	69.4	30.02	8.2
6/13/99	1:00	4.1	158.7	57.6	70.4	30.02	8.8
6/13/99	1:15	4.5	175.7	57.4	70.7	30.01	13.4
6/13/99	1:30	3.7	177.6	57.5	70.1	30.01	16.6
6/13/99	1:45	3.6	183.3	57.2	70.9	30.01	13.8
6/13/99	2:00	3.7	154.5	57.1	71	30.01	14.6
6/13/99	2:15	3.5	156.8	56.7	72	30.01	10.3
6/13/99	2:30	3.2	150.9	56.2	72.4	30.01	6.1
6/13/99	2:45	3.8	139.5	55.8	73.5	30	7.5
6/13/99	3:00	4.2	137.6	55.8	73.2	30	5.2
6/13/99	3:15	3	118.1	54.8	74.7	30	9.5
6/13/99	3:30	3.8	119.6	54.5	75.9	29.99	14.4
6/13/99	3:45	4	126.8	53.6	77.1	29.99	14.2
6/13/99	4:00	3.5	151.7	53.4	77.9	29.99	27.9
6/13/99	4:15	3.5	203.6	54.5	76.5	29.99	20.3

Atrazine Application Meteorological Data

Export Filename : C:\MICROMET\ATRI15\EXPORT\99060714.TXT
Export data for station : Atrazine Application

Date	Time	WS	WD	AT	RH	BP	Sigma
		(mph)	(Deg)	(Deg F)	(%)	(inHg)	(Deg)
6/13/99	4:30	4.2	145.1	53.9	77.3	29.98	19.5
6/13/99	4:45	4	195.5	54	77.5	29.98	14.1
6/13/99	5:00	3.9	189.5	54	77.9	29.98	10
6/13/99	5:15	4.2	185.7	53.7	78.6	29.98	6.8
6/13/99	5:30	4.2	172.2	53.5	79.2	29.98	8.4
6/13/99	5:45	5	183.1	53.4	79.3	29.98	11.4
6/13/99	6:00	4.9	187	53.2	79.8	29.98	14.4
6/13/99	6:15	4.8	186.5	53.6	79	29.98	9.1
6/13/99	6:30	4.8	175.3	54.1	77.8	29.98	16.9
6/13/99	6:45	5.3	173.8	54.9	76.9	29.99	13.7
6/13/99	7:00	4.4	148.4	55.5	76	30	13.4
6/13/99	7:15	4.1	173.9	56.3	74.6	30	18.5